Curriculum For three-Years(Six Semester) Diploma Course in

PLASTIC MOULD TECHNOLOGY

SYLLABUS FOR

DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY

Effective From :-

UNDER DEVELOPMENT

Prepared by:

Curriculum development cell
Institute of Research Development & Training,
Kanpur

Approved by:
Board of Technical Education, U. P., Lucknow
On Dated 27.05.2015

Corrected and Approve By B.T.E. Meeting On Dated 27.05.2015

STUDY AND EVALUATION SCHEME FOR
THREE YEARS (SIX SEMESTER) DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY

(Effective From)

I Semester

Curriculum						S U B J E C T	Scheme of Examination							
Periods Per Week							Theory			Practical			Grand Total
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Examination Marks	Sess. Marks	Total Marks	Examination Dur.	Examination Marks	Sess. Marks	Total Marks	
5	-	-	3	-	8	1.1 Professional Communication	2.5	50	20	70	3	20	10	30	100
3	1	-	-	-	4	1.2 Applied Mathematics-I(A)	2.5	50	20	70	-	-	-	-	70
3	1	-	-	-	4	1.3 Applied Physics-I	2.5	50	20	70	-	--	--	--	70
6	-	-	4	-	10	1.4 Applied Chemistry	2.5	50	20	70	3	40	20	60	130
-	-	14	-	-	14	1.5 Engineering Drawing	3.0	50	20	70	-	-	-	-	70
			8		8	Student Centered Activities)									
17	2	14	15	-	48	<---------TOTAL---------->	--	250	100	350		60	30	90	440
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25
														TOTAL	465

II Semester

3	1	-	-	-	4	2.1 Applied Mathematics-I(B)	2.5	50	20	70	-	-	-	-	70
3	1	-	4	-	8	2.2 Applied Physics-II	2.5	50	20	70	3	40	20	60	130
5	1		2	-	8	2.3 Applied Mechanics	2.5	50	20	70	3	40	20	60	130
5	-	-	-	-	5	2.4 Elementary Workshop Tech.	2.5	50	20	70	-	--	--	--	70
-	-	-	-	14	14	2.5 Workshop Practice	--	--	--	--	4	60	30	90	90
						2.6 Field Exposure-I	--	--	--	--	2	--	30	30	30
						(Assessment at Instt. Level)									
			8		8	Student Centered Activities)									
16	3	-	14	14	47	<---------TOTAL---------->	--	200	8 0	280		140	100	240	520
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25
														TOTAL	545

NOTE:- (1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) Student centered activities will compromise of various co-curricular activities like semina, Extension lectures, field visits, NCC, NSS, Hobby clubs, Games and cultural activities
(6) After the I Semester Exam. two week visit of a small/medium size industry. It will be structured and supervised by the institution. Purpose of the visit is to give students an exposure of industrial setup and that of simple tools, instruments and the skill there in day to day use. Every student will submit the institution a report of his visit. The report will invaribly contain the discription of his observations about (1) Products/Work (2) Tools and Equipments Used. He will be evaluated at the institution level for 30 marks--20 for viva and 10 for the reprot presented. See Annexure -I.

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STUDY AND EVALUATION SCHEME FOR
THREE YEARS (SIX SEMESTER) DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY

(Effective From)

III Semester

Curriculum							Scheme of Examination							
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total
Lec.	Tutorial	Draw	Lab	Work Shop	Total		Examination Dur.	Marks	Sess. Marks	Total Marks	Examination Dur.	Marks	Sess. Marks	Total Marks	
5	2	-|	-	-	7	3.1 Applied Mathematics-II	2.5	50	20	70	--	--	--	--	70
5	2	-|	4	-	11	3.2 Metrology & Measuring Instrument	2.5	50	20	70	3	40	20	60	130
5	2	-|	4	-	11	3.3 Hydraulics & Pneumatic System	2.5	50	20	70	3	20	10	30	100
4	2	-|	4	-	10	3.4 Materials & Metallurgy	2.5	50	20	70	3	50	20	70	140
			8		8	Student Centered Activities)									
19	8	-|	20	-	47	<---------TOTAL---------->	--	200	80	280		110	50	160	440
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25
														TOTAL	465

IV Semester

2	-	-|	5	-	7	4.1 Basics of Inforation Tech.	2.5	50	20	70	3	60	30	90	130
5	-	-|	-	-	5	4.2 Electrical Technology and Electronics	2.5	50	20	70	--	--	--	--	70
7	-	-|	-	-	7	4.3 Plastic Materials	2.5	50	20	70	--	--	--	--	70
5	2	-|	6	-	13	4.4Plastic Process Techniques-I	2.5	50	20	70	3	50	20	70	140
5	2	-|	4	-	11	4.5 Design of Dies & Mould-I	2.5	50	20	70	3	50	20	70	140
			5		5	Student Centered Activities)									
24	4	-|	20	-	48	<---------TOTAL---------->	--	250	100	300		160	70	230	530
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25
														TOTAL	555

NOTE:- (1) Each period will be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 1425 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) S. I. system of units shall be used in each subject.
(6) Student centered activities will compromise of various co-curricular activities like semina, Extension lectures, field visits, NCC, NSS, Hobby clubs, Games and cultural activities
(7) Minumum 4 weeks industrial/field visit to be organized after IV semester exam. Student will submit a report to the external examiner in VI semester(See Ann. II)

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STUDY AND EVALUATION SCHEME FOR
THREE YEARS (SIX SEMESTER) DIPLOMA COURSE IN PLASTIC MOULD TECHNOLOGY

(Effective From)

V Semester

Curriculum							Scheme of Examination							
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total
Lec.	Tutorial	Project	Lab	Work Shop	Total		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Marks	Sess. Marks	Total Marks	
6	2	-	-	-	8	5.1 Industrial Management and Entrepreneurship Development	2.5	50	20	70	--	--	--	--	70	
5	2	-	7	-	14	5.2Plastic Process Techniques-I	2.5	50	20	70	3	60	30	90	160	
5	2	-	7	-	14	5.3 Design of Dies & Mould-II	2.5	50	20	70	3	50	30	80	150	
			8		8	Student Centered Activities)										
16	6	-	22	-	44	<---------TOTAL---------->	--	150	60	210	--	110	60	170	380	
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25	
														TOTAL	405	

VI Semester

Curriculum							Scheme of Examination							
Periods Per Week						S U B J E C T	Theory			Practical			Grand Total
Lec.	Tutorial	Project	Lab	Work Shop	Total		Examination Dur.	Sess. Marks	Total Marks	Examination Dur.	Marks	Sess. Marks	Total Marks	
5	2	-	5	-	12	6.1 Environmental Pollution in in Plastic Industries	2.5	50	20	70	3	50	20	70	140	
6	2	-	6	-	14	6.2 Plastic Testing & Quality Control	2.5	50	20	70	3	50	30	80	150	
-	-		12	-	12	6.3 Computer Aided Mould Design Lab Practicals	--	--	--	--	3	50	20	70	70	
-	-	5	-	-	5	6.4 Project	--	--	--	--	3	100	50	150	150	
-	-	-	-	-	-	6.5 Field Exposure	--	--	--	--	-	40	20	60	60	
			5		5	Student Centered Activities)										
11	4	5	28	-	48	<---------TOTAL---------->	--	100	40	140	--	290	140	430	570	
						Games/NCC/Social and Cultural Activities + Discipline (15 + 10)									25	
														TOTAL	595	

NOTE:-
(1) Each period will of be 50 minutes duration.
(2) Each session will be of 16 weeks.
(3) Effective teaching will be at least 14 weeks.
(4) Remaining periods will be utilised for revision etc.
(5) Each group of 2 to 3 students may choose one problem from the project paper.
(6) Field visits and Extension lectures at institute level as per need be arranged.
(7) (*) It is compulsory to appear & to pass in examination, But marks will not be included for division and percentage of obtained marks.

30% Carry Over of I & II Semester	303
70% Carry Over of III & IV Semester	714
100% Carry Over of V & VI Semester	1000
Aggegate	2017

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C O N T E N T S

DETAILED COURSE CONTENTS

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II- MAIN FEATURES OF THE CURRICULUM

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

Duration: Three Years(Six Semester)

Pattern of the course: Semester System

Intake: 60

Type of course: Full Time

Entry qualification: Passed High School with 35% Marks

Mode of admission: Through Joint Entrance Examination

III-LIST OF EXPERTS

List of experts whose contribution helped the development of curriculum in semester system for Three Year(Six Semester) Diploma Course in Plastic Mould Technology are honorably named below on dated 17.04.15 at IRDT, UP, Kanpur

1.	Sh. D. P. Yadav Chief Manager	C.I.P.E.T., Lucknow
2.	Sh. Abdul Rehman Manager	C.I.P.E.T., Lucknow
3.	Sh.R.C.Soni H.O.D. Mech.Engg.	Govt.Polytechnic,Faethpur
4.	Sh.S. N. Maurya H.O.D. Mech.Engg.	Govt.Polytechnic,Sikendra
5.	Sh.C. B. Prajapati Lecturer	Govt.Polytechnic,Faethpur
6.	Mrs. Meenu Dwivedi Lectrurer	Govt. Poly, Lucknow
7.	Shri. M.P.Singh Bhadauria H.O.D.&C.D.C Co.ordinator	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 Semester

1.1 PROFESSIONAL COMMUNICATION

[Common to All Engineering/Non Engineering Courses]

L	T	P
5	-	3

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.	10	-	-
3.	Development of expression through			
	A. Letters(English & Hindi)	10	-	-
	B. Report writing (English)	10	-	-
	Note making and minutes writing			
4.	Paragraph writing, Essey writing, Proposal writing	10	-	-
5.	Composition	10	-	-
6.	Remecial Grammer & Vocabulary Building	15	-	-
		70	-	42

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

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

1.2 Technical communication Vs. General Communication : Development of comprehension and knowledge of English through the study of text material and language exercises based on the prescribed text book of English.

1.3 Development of expression through:

1.3.1 Paragraph writing, Essay writing, Proposal writing.

1.3.2 Business and personal correspondence (Letters) :
Kinds of letters:-
Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters. Application for a job, Resume.

1.3.3 Report writing and Note making and minutes writing.

1.4 Functional Grammer : Study of sentences and parts of speech (word class), Preposition, Verb, Articles, Abbreviations.

1.5 Vocabulary Building : Homophones, One word substitution, Idioms and Phrases.

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

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

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

2.2 Development of expression through ;

Letter writing in Hindi:
Kinds of letters:-
Official, demi-offical, unofficial , for reply or in reply, quotation, tender and order giving letters, Application for a job, Press release in Hindi, Report writing.

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

REFERENCE BOOKS

1. Bookshelf worksheet of Professional Communication, New Delhi : Bookshelf 2008

2. Functional Skills in language and literature by R. P. Singh, New Delhi : Oxford University Press.

3. Oxford Engilsh Hindi English Dictionary, New Delhi : Oxford 2008

LANGUAGE LAB PRACTICE

For the practice/exercise the following is suggested :-

1.A. Phonetic transcription
B. Stress and intonation :
(At least 10 word for writting and 10 word for pronunciation)

2. ASSIGNMENT : (Written Communication)

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

THE FOLLOWING MODEL IS PROPOSED :

1. a picture/photograph
2. an opening sentence or phrase

3. a newspaper/magzine clipping or report
4. factual writting which should be informative or argumentative.

(The students may refer to "Bookshelf worksheet" for technical communication)

3. Oral Conversation:

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

4. Aural :

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

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

10 marks for assignment (Given by subject teacher as sessional marks)
10 marks for conversation and viva-voce
10 marks for phonetic transcription

STRUCTURE OF THE PAPER OF PROFESSIONAL COMMUNICATION

Distribution of Marks

Theory Paper : 50 Marks
Sessional : 20 Marks
Pratices : 30 Marks

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

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

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

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

Q3. Report Writting on given outlines 5 Marks

Q4. There will be a number of short answer questions to test the candidates knowledge of functional grammer, 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 expresed 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 Noune 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 abbrevation, uses of idioms and Phrases, Homophones.

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

Candidates will be required to select one composition topic from a choice of five. The choice will normally include narrative descriptive, argumentative, discussion and factual topics. The main ceteria 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(A)
[Common to All Engineering Courses]

L	T	P
3	2/2	-

Rationale:

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

S.N.	Units	Coverage Time L	T	P
1.	Algebra- I	8	3	-
2.	Algebra- II	8	3	-
3.	Trignometry	6	2	-
4.	Differential Calculus-I	10	3	-
5.	Differential Calculus-II	10	3	-
		42	14	-

DETAILED CONTENTS:

1. ALGEBRA-I : (10 Marks)

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

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

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

2. ALGEBRA-II:(10 Marks)

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

2.2 Complex number.

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

3. TRIGONOMETRY :(8 Marks)

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

3.2 Inverse circular functions : Simple case only

4. DIFFERENTIAL CALCULUS - I : (12 Marks)

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

differentiability.

4.2 Methods of finding derivative, - Function of a function, Logaritimic differentiation, Differentiation of implicit functions.

5. DIFFERENTIAL CALCULUS -II :(10 Marks)

5.1 Higher order derivatives, Leibnitz theorem.

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

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

1.3 APPLIED PHYSICS-I

[Common to All Engineering Courses]

L	T	P
3	2/2	-

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Units & Dimensions	3	1	-
2.	Errors in Measurement	3	1	-
3.	Circular Motion	4	1	-
4.	Motion of Planets	4	1	-
5.	Dynamics of rigid body (Rotational Motion)	5	1	-
6.	Fluid Mechanics and Friction	4	1	-
7.	Friction	4	1	-
8.	Harmonic Motion	5	2	-
9.	Heat & Thermodynamics	6	4	-
10.	Acoustics	4	1	-
		42	14	-

DETAILED CONTENTS:

1. Units and Dimensions (4 Marks)

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

i) Checking the correctness of physical equations,

ii) Deriving relations among various physical quantities,

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

2. ERRORS AND MEASUREMENT (4 Marks)

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

3. Circular Motion (5 Marks)

Central forces. Uniform Circular motion (Horizental and Vertical cases),angular velocity,angular acceleration and centripetal acceleration.Relationship between linear and angular velocity and acceleration. Centripetal and

centrifugal forces. Practical applications of centripetal forces. Principle of centrifuge.

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

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

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

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

6. Fluid Mechanics :(5 Marks)

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

7. Friction :(4 Marks)

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

8. Harmonic Motion (6 Marks)

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

9. Heat & Thermodynamics: (6 Marks)

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

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

1.4 APPLIED CHEMISTRY

[Common to All Engineering Courses]

L	T	P
6	-	4

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Atomic Structure	4	-	-
2	Chemical Bonding	6	-	-
3.	Classification of Elements	4	-	-
4.	Electro Chemistry-I	7	-	-
5.	Electro Chemistry-II	8	-	-
6.	Chemical Kinetics	4	-	-
7.	Catalysis	4	-	-
8.	Solid State	4	-	-
9.	Fuels	4	-	-
10.	Water Treatment	6	-	-
11.	Colloidal State	4	-	-
12.	Lubricants	4	-	-
13.	Hydrocarbons	7	-	-
14.	Organic Reactions & Mechanism	8	-	-
15	Polymers	4	-	-
16	Synethetic Materials	6	-	-
		84	-	56

DETAILED CONTENTS:

1. ATOMIC STRUCTURE :(3 MARKS)

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

2. CHEMICAL BONDING :(4 MARKS)

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

3. CLASSIFICATION OF ELEMENTS :(3 MARKS)

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

4. ELECTRO CHEMISTRY-I:(3 MARKS)

Arrhenius Theory of electrolytic dissociation, Transport number, Electrolytic conductance, Ostwald dilution law. Concept of Acid and bases : Bronsted, Arrhenius and Lewis theory. Concept of pH and numericals. Buffer solutions, Indicators, Solubility product, Common ion effect with their application,

5. ELECTRO CHEMISTRY-II:(3 MARKS)

Redox reactions, Electrode potential(Nernst Equation), Electro-chemical cell (Galvanic and Electrolytic). EMF of a cell and free energy change. Standard electrode potential, Electro chemical series and its application. Chemical and Electrochemical theory of corrosion, Galvenic Series. Prevention of corrosion by various method.

6. CHEMICAL KINETICS :(3 MARKS)

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

7. CATALYSIS :(2 MARKS)

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

8. SOLID STATE :(2 MARKS)

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

9. FUELS :(3 MARKS)

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

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

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

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

Numerical Problems based on topics

10. WATER TREATMENT :(3 MARKS)

Hardness of water, Its limits and determination of hardness of water by EDTA method. Softening methods (Only Sods lime, Zeolote and Ion exchange resin process). Disadvantage of hard water in different industries, scale and sludge

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

Disinfecting of Water By Chloramine-T, Ozone and Chlorine. Advantage and disadvantage of chlorinational, Industrial waste and sewage, Municipality waste water treatment, Definition of BOD and COD. Numerical Problems based on topics.

11. COLLOIDAL STATE OF MATTER :(3 MARKS)

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

12. LUBRICANTS :(3 MARKS)

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

13. HYDROCARBONS:(4 MARKS)

A. Classification and IUPAC nomeuclature of organic compounds hamologous series (Functional Group)

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

14. ORGANIC REACTIONS & MECHANISM:(4 MARKS)

1. Fundamental auspects -

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

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

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

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

15. POLYMERS :(3 MARKS)

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

2. Thermosetting and Thermoplastic resen -

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

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

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

16. SYNETHETIC MATERIALS :(4 MARKS)

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

LIST OF PRACTICALS

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

A. Basic Radicals :

NH4+, Pb++, Cu++, Bi+++, Cd++, As+++, Sb+++,

Sn++, Al+++, Fe+++, Cr+++, Mn++, Zn++, Co++

Ni++, Ba++, Sr++, Ca++, Mg++

B. Acid Radicals :

CO3--, S--, SO3--, CH3COO-, NO2-,

No3- , Cl-, Br_ , I- , So4--

2. To determine the percentage of available Chlorine in the supplied sample of Bleaching powder.

3. To determine the total hardness of water sample in terms of CaCo3 by EDTA titration method using Eriochroma black-T indicator.

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

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

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

1.5 ENGINEERING DRAWING

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

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

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

L	T	P
-	-	14

Rationale

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

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

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

Sl.N.		Units	Coverage Time L	T	P
1.		Drawing Instruents and their use	-	-	4
2.	A.	Lettering techniques	-	-	16
	B.	Introduction to scales	-	-	8
3.		Conventional Presentation	-	-	8
4.	A.	Principles of projections	-	-	12
	B.	Point Line, Plane	-	-	28
5.		Orthographic projection of simple geometrical solids	-	-	12
6.		Section of Solids	-	-	20
7.		Isometric Projection	-	-	20
8.		Free Hand Sketching	-	-	8
9.		Development of surfaces	-	-	24
10.		Orthographics Projection of Machine Parts	-	-	12
11.		Practice on Auto Cad	-	-	24
			-	-	196

C O N T E N T S

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

1. Drawing, instruments and their uses. 1 Sheet

1.1 Introduction to various drawing, instruments. 1

1.2 Correct use and care of Instruments.
1.3 Sizes of drawing sheets and their layouts.

2. (a) Lettering Techniques 2 Sheet

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

Printing of vertical and inclined normal single stroke numbers.

Stencils and their use.

(b) Introduction to Scales 2 Sheet

Necesssity and use, R F

Types of scales used in general engineering drawing. Plane, diagonal and chord scales.

3. Conventional Presentaion : 1 Sheet

Thread (Internal and External), Welded joint, Types of lines, Conventional representation of materials, Conventional representation of machine parts.

4. (a) Principles of Projection 1 Sheet

Orthographic, Pictorial and perspective.

Concept of horizontal and vertical planes.

Difference between I and III angle projections.

Dimensconing techniques.

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

5 (a) Orthographic Projections of Simple 2 Sheet

Geometrical Solids

Edge and axis making given angles with the reference planes. Face making given angles with reference planes. Face and its edge making given angles with referance planes.

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

(c) Exercises on missing surfaces and views

6. Section of Solids 2 Sheet

Concept of sectioning

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

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

7. Isometric Projection. 2 Sheet

Isometric scale

Isometric projection of solids.

8. Free hand sketching 1 Sheet

Use of squared paper

Orthographic views of simple solids

Isometric views of simple job like

carpentary joints

9. Development of Surfaces 2 Sheet

Parallel line and radial line methods of developments.

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

10. ORTHOGRAPHIC PROJECTION OF MACHINE PARTS: 2 Sheet

Nut and Bolt, Locking device, Wall bracket

11. PRACTICE ON AUTO CAD : 2 Sheet

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

NOTE :

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

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

II Semester

2.1 APPLIED MATHEMATICS I (B)

[Common to All Engineering Courses]

L	T	P
3	2/2	-

Rationale:

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

S.N.	Units	Coverage L	T	P	Time
1.	Integral Calculus-I	12	4	-	
2.	Integral Calculus-II	12	4	-	
3.	Coordinate Geometry (2 Dimensional)	10	3	-	
4.	Coordinate Geometry (3 Dimensional)	8	3	-	
		42	14	-	

DETAILED CONTENTS:

1. INTEGRAL CALCULUS - I : (14 Marks)

Methods of Indefinite Integration :-

1.1 Integration by substitution.

1.2 Integration by rational function.

1.3 Integration by partial fraction.

1.4 Integration by parts.

2. INTEGRAL CALCULUS -II :(14 Marks)

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

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

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

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

3.1 CIRCLE :

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

3.2 Standard form and simple properties

Parabola x2=4ay, y2=4ax,

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

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

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

4.1 Straight lines and planes in space -

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

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

2.2 APPLIED PHYSICS-II

[Common to All Engineering Courses]

L	T	P
3	2/2	4

Rationale:

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

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Topics	L	T	P
1.	Optics	4	1	-
2.	Introduction To Fiber Optics	4	1	-
3.	Laser & its Application	4	1	-
4.	Electrostatics	4	1	-
5.	D.C. Circuits	4	1	-
6.	Magnetic Materials & Their Properties	4	1	-
7.	Semi Conductor Physics	4	1	-
8.	Introduction Diode & Transistors	4	2	-
9.	Introduction To Digital Electronics	4	2	-
10.	Non-conventional energy sources	6	3	-
		42	14	56

1. Optics (4 Marks)

Nature of light, Laws of Reflection and Refraction, Snell's Law, Interference (Constructive and Deotructive), Diffraction and Polarization (Concept Only), Law of Mallus and Polaroids.

2. Introduction To Fibre Optics :(5 Marks)

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

3. Lasers and its Applications (4 Marks)

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

4. Electrostatics :(4 Marks)

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

5. D.C. Circuits (5 Marks)

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

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

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

7. Semiconductor Physics (4 Marks)

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

8. Junction Diode and Transister : (6 Marks)

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

9. Introduction To Digital Electronics : (6 Marks)

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

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

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

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

PHYSICS LAB

Note: Any 4 experiments are to be performed.

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

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

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

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

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

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

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

8. Determination of specific resistance by Carry Foster bridge.

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

10. Verification of Kirchoff's Law.

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

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

NOTE :

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

2.3 APPLIED MECHANICS

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

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

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

L	T	P
5	1	2

RATIONALE

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

TOPIC WISE DISTRIBUTION OF PERIODS

SL.No.	Topic	L	T	P
1.	Introduction	4	1	
2.	System of Forces & General Condition of Equilibrium	18	4	
3.	Moment and Couple	8	1	
4.	Friction	8	1	
5.	Machines	8	1	
6.	Center of Gravity	8	2	
7.	Moment of Inertia	8	2	
8.	Beam & Trusses	8	2	
	Total	70	14	28

DETAILED CONTENTS

1. Introduction:

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

2.A. System of Forces :

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

force system.

B. General Condition of Equilibrium:

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

3. Moment & couple:

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

4. Friction:

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

5. Machines:

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

6. Centre of Gravity:

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

7. Moment of Inertia:

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

8. Beams & Trusses:

Definition of statically determinate and indeterminate trusses. Types of supports. Concept of tie & strut, Bow's notation, space diagram, polar diagram, funicular polygon; calculation of reaction at the support of cantilever and simply supported beams and trusses graphically and

analytically; graphical solution of simple determinate trusses with reference to force diagram for determining the magnitude and nature of forces in its various members. Analytical methods: method of joints and method of sections.(simple problems only)

Applied Mechanics Lab : Practicals

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

2.4 ELEMENTARY WORKSHOP TECHNOLOGY
(Common with Diploma In Dairy Engineering)

L	T	P
5	-	-

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	5	-	-
C.	Familiarity With Tools	5	-	-
4.	Protection of Fabricated Structure from Weather			
1.	Painting	5	-	-
2.	Varnishing & Polishing	3	-	-
5.	Foundry Work	5	-	-
6.	Machine Shop	5	-	-
		70	-	-

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, Rivetting,Fitting and Plumbing.

(c) Organization and layout of workshop.
(d) General safety preaction in workshop

2. CARPENTRY :

(a) Types of wood and timber, Cutting and seasoning of wood, Decaying of wooden component.

(b) Fundamental of wood working operations:

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

(c) 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 supproting Tools:

Carpentary 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.

(d) 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, Mitre & briddle joints. Uses of glue, dowelpin 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, usetting, 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 pein, cross pein ,Straight pein double face and sledge hammers .

(6) Cutting tools - Hot and cold chisel and shear set.

(7) Punching & Drifiting 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.

(12) Study of forge hammers and power presses.

(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,wirededge, cup or circuler, Flange, angular and cap.

(3) Tools and equipments used (Name, size, specification for identification only).

(4) Marking Tools- Scriber, Divider and Trammel, Protractor, Trysquare, 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, Plier, C or G clamps, Tongs.

(9) Supporting Tools-Stakes and Anvil.

(10) Bending Tools-Crimpers, Form dies, Roundnose plier, 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.

(15) Development and estamination of sheet for simple articles.

(B) Metal Joining During Fabrication:

(1) Permanent Joining:

(a) (1) Welding methods-Forgewelding, 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 Galvanised and Tincoated 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 discription (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) Rivetting:

(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 rievet tail, shaping head and caulking.

(4) Tools and equipments used- (Names, Size, Specification and uses)-Supporting and holding tools (Stakes and Tonqs)-Striking tools-Ball pien, Straight pien and Cross pien hammers and head forming tools (Shapes), drills punches and solid punches, drift, elementary knowledge about working of pneumatic, hydraulic and electric rivetor.

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

Introduction to

(1) Various types of Bolts (Names of prats 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 cottors-their material and use.

(3) Pipe connectors-Sockets, elbows, tees, cross and bends, unions, volves, 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 Discription 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 lickely 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, trysquare, scriber, punches, divider and callipers, surface plate, V. block, gauges- (screw, pitch, radius, feeler), Vernier callipers, Micrometer, Vernier height and depth gauge, use of dialgauge.

Holding Tools:

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

Cutting Tools:

Hack saw (Fixed and Adjustable framce), 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, Spaners, 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 famillarity.

4. PROTECTION OF FABRICATED STRUCTURES FROM WEATHER:

1. PAINTING:

Its need, Introduction to methods of paintings (Classification only); Mannual, Machine (spray) and dip painting at room temperature, operations involved- discription of steps only eg. surface preparation method for old and new surface in timber and iron structure-sanding, derusting, deqreasing, 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 indification).

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, Types of moulds, sand and 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.

2.5 WORKSHOP PRACTICE

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

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

L	T	P
-	-	14

Rationale

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

Sl.No.	Units	Coverage L	T	Time P
1.	Carpentry shop	-	-	20
2.	Painting & polishing shop	-	-	16
3.	Sheet metal and soldering shop	-	-	56
4.	Fitting shop, Plumbing & Fastening Shop	-	-	24
5	Foundry shop			20
6.	Smithy shop	-	-	24
7.	Welding shop	-	-	20
8.	Machine shop	-	-	16
		-	-	196

DETAILED CONTENTS

1. Carpentry Shop :

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

EX-2 Planing and sawing practice

EX-3 Making of lap joint

EX-4 Making of mortise and tenon joint

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

2. Painting and Polishing Shop:

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

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

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

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

* The sequence of polishing will be as below:
i) Abrassive cutting by leather wheel.
ii) Pollishing with hard cotton wheel and with polishing material.
iii) Buffing with cotton wheel or buff wheel.

3. Sheet Metal and Soldering Shop :

EX-1 Introduction and Types of sheets, measuring of sheets
EX-2 Study and sketch of various types of stakes/anvil.
EX-3 Introduction & demonstration of tools used in Sheet metal working shop.
EX-4 Cutting, shearing and bending of sheet.
EX-5 To prepare a soap case by the metal sheet.
EX-6 To make a funnel with thin sheet and to solder the seam of the same.
EX-7 To make a cylinder and to solder the same.
EX-8 Preparation of different type of joints such as Lap joint-single seam, double seam. Hemp and wired joints.
EX-9 To braze small tube/conduit joints.

4. Fitting Shop, Plumbing Shop & Fastening Shop:

EX-1 Study of materials, limits, fits and toterances.
EX-2 Introduction & demonstration of tools used in Fitting Shop.
EX-3 Hacksawing and chipping of M.S. flat. Filing and squaring of chipped M.S. job. Filing on square or rectangular M.S. piece.
EX-4 Making bolt & nut by tap and die set and make its joints
Ex-5 To drill a hole in M.S. Plate and taping the same to creat threads as per need.
EX-6 Utility article-to prepare double open mouth spanner for 18" hexagonal head of a bolt.
EX-7 Cutting and threading practice for using socket, elbow and tee etc. and to fit it on wooden practice board.
EX-8 Study of-bib cock, cistern or stop cock, wheel valve and gate valve etc.
EX-9 Practice of bolted joints
EX-10 To prepare a rivetted joint
EX-11 To make a pipe joint
EX-12 To make a threaded joint
EX-13 Practice of sleeve joint

5. Foundry Work

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

6. Smithy Shop :

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

EX-4 Utility article-to preapre a ceiling fan hook.

7. Welding Shop :

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

8. Machine Shop

EX-1 Study & sketch of lathe machine.
EX-1 Study & sketch of grinders, milling M/c, Drilling M/c and CNC Machines
Ex-2 Plain and step turning & knurling practice.
Ex-3 Study and sketch of planning/Shaping machine and to plane a Ractangle of cast iron.

2.6 FIELD EXPOSURE-1

The purpose of this course is to train the students to learn working in factory situations under supervision of factory staff and polytechnic staff. The whole department faculty should be deputed for this purpose.

Head of faculty should procure seats for giving summer training for students with the assistance of Director, Board of Apprenticeship Training.

A small project like study of material handling system, Plant layout study, Inventory control, Work study, Process control rejection and rework study, Inspection system and Quality control, etc. may be alloted.

III Semester

3.1 APPLIED MATHEMATICS II

[Common to All Engineering Courses]

L	T	P
5	2	-

Rationale :

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

Sl.No.	Units	Coverage Time L	T	P
1.	Matrices	16	6	-
2.	Differential Calculus	15	6	-
2.	Differential Equations	15	6	-
4.	Integral Calculus	12	5	-
5.	Probability & Statistics	12	5	-
		70	28	-

DETAILED CONTENTS

1. MATRICES :(12 Marks)

1.1 Algebra of Matrices, Inverse :

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

Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation :

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

1.3 Linear Dependence, Rank of a Matrix :

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

1.4 Eigen Pairs, Cayley-Hamilton Theorem :

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

and powers of a matrix.

2. DIFFERENTIAL CALCULUS :(10 Marks)

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

2.2 Partial Differentiation :

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

2.3 Vector Calculus :

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

3. DIFFERENTIAL EQUATION :(10 Marks)

3.1 Formation, Order, Degree, Types, Solution :

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

3.2 First Order Equations :

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

3.3 Higher Order Linear Equation :

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

3.4 Simple Applications :

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

4. INTEGRAL CALCULUS - II: (12 Marks)

4.1 Beta and Gamma Functions :

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

4.2 Fourier Series :

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

4.3 Laplace Transform :

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

5. PROBABILITY AND STATISTICS :(6 Marks)

5.1 Probability :

Introduction, Addition and Multiplication theorem and simple problem.

5.2 Distribution :

Discrete and continuous distribution, Bionimal Distribution, Poisson Distribution, Normal Distribution..

3.2 METROLOGY AND MEASURING INSTRUMENTS

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

L	T	P
5	2	4

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 philosphy of subject and measuring instruments are means. Both are equally improtant for engineer's at every stage of their work pursuit. The paper aims to enable the student to envisage such aspecets of the job at hand.

TOPIC WISE DISTRIBUTION OF PERIODS

Sl.No.	Units	Coverage L	T	P	Time
1.	Introduction	5	2	-	
2.	Principle & Classifications of Measuring Instruments	9	3	-	
3.	Transducers	5	2	-	
4.	Comparators	9	3	-	
5.	Surface Finish	6	2	-	
6.	Various Types of Instruments Used For	12	5	-	
i. a.	Physical Measurement				
b.	Liquid Level & Viscosity				
ii.	Mechanical Quantities				
7.	Temperature Measurement	5	2	-	
8.	Special Measuring Devivces	5	2	-	
9.	Measurement of Vibrations	5	2	-	
10.	Inspection of Geometrical Errors	9	3	-	
		75	28	56	

DETAILED CONTENTS

1. INTRODUCTION:

Meaining and scope of metrology in field of engineering. standards and types of mesaurements (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 comprators, construction and working of dial indicator, johanssen "Mikrokator", read type mechanical comparator, mechnical-optical, zeiss optotest, electro limit, electromechanical, electronics, penumatic 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,

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 vernior calliper and micrometer.
11. Use of height gauge and vernier collipers.
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 liverty to develop and conduct practical according availability of items to be measured by the instrument. Every year the items to be measured, shall be chage 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.

3.3 HYDRAULIC AND PNEUMATIC SYSTEMS

L	T	P
5	2	4

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 Bernoullie'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)

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.

3.4 MATERIALS AND METALLURGY

L T P
4 2 4

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 form 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)

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

IV Semester

4.1 BASICS OF INFORMATION TECHNOLOGY

L	T	P
2	-	5

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 envelops and lables
- 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 MSExcel, 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

4.2 ELECTRICAL TECHNOLOGY & ELECTRONICS

(Common With Mech. Engg., Dairy Engineering)

L	T	P
5	-	-

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

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.

4.3 PLASTIC MATERIALS

L	T	P
7	-	-

RATIONALE

This subject gives a detailed description of polymeric materials in category of thermoplastics, thermosets and thermoplastic elastomers. The students acquires 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)

4.4 PLASTICS PROCESSING TECHNIQUES -I

L T P
5 2 6

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)

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

4.5 DESIGN OF DIES AND MOULDS-I

L T P
5 2 4

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 piller, 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)

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

V SEMESTER

5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

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

RATIONALE

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

TOPIC WISE DISTRIBUTION OF PERIODS

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

DETAILED CONTENTS

1. **Principles of Management**
   - 1.1 Management, Different Functions: Planning, Organising, Leading, Controlling.
   - 1.2 Organizational Structure, Types, Functions of different departments.
   - 1.3 Motivation: Factors, characteristics, methods of improving motivation, incentives, pay, promotion, rewards, job satisfaction, job enrichment.
   - 1.4 Need for leadership, Functions of a leader, Factors for accomplishing effective leadership, Manager as a leader, promoting team work.
2. **Human Resource Development**
   - 2.1 Introduction, objectives and functions of human resource development (HRD) department.
   - 2.2 Recruitment, methods of selection, training strategies and career development.
   - 2.3 Responsibilities of human resource management – policies and functions, selection – Mode of selection – Procedure – training of workers, Job evaluation and Merit rating.
3. **Wages and Incentives**
   - 3.1 Definition and factors affecting wages, methods of wage payment.
   - 3.2 Wage incentive – type of incentive, difference in wage, incentive and bonus; incentives of supervisor.
   - 3.3 Job evaluation and merit rating.
4. **Human and Industrial Relations**
   - 4.1 Industrial relations and disputes.
   - 4.2 Relations with subordinates, peers and superiors.
   - 4.3 Characteristics of group behaviour and trade unionism.
   - 4.4 Mob psychology.
   - 4.5 Grievance, Handling of grievances.
   - 4.6 Agitations, strikes, Lockouts, Picketing and Gherao.
   - 4.7 Labour welfare schemes.

4.8 Workers’ participation in management.

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

6. **Sales and Marketing management**
   - 6.1 Functions and duties of sales department.
   - 6.2 Sales forecasting, sales promotion, advertisement and after sale services.
   - 6.3 Concept of marketing.
   - 6.4 Problems of marketing.
   - 6.5 Pricing policy, break even analysis.
   - 6.6 Distribution channels and methods of marketing.

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

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

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

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

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

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

5.2 PLASTIC PROCESSING TECHNIQUES - II

L T P

5 2 7

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 assited 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)

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

5.3 DESIGN OF DIES AND MOULDS - II

L T P
5 2 7

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)

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.

VI SEMESTER

6.1 ENVIRONMENT AND POLLUTION IN PLASTIC INDUSTRY

L	T	P
5	2	5

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 bio-degradation 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 benifit of vulnerability reduction, Factor promoting vulnerability reduction and mitigation, Emergency support function plan.
Main feature and function of National Disaster Management Frame Work, Disaster mitigation and prevention, Legal Policy Frame Work, Early warning system, Human Resource Development and Function, Information dissemination and communication.

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

6.2 PLASTIC TESTING AND QUALITY CONTROL

L	T	P
6	2	6

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)

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.

6.3 COMPUTER AIDED MOULD DESIGN

L	T	P
-	-	12

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.

6.4 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.

6.5 FIELD EXPOSURE-II

SEE ANNESURE-II

DIPLOMA IN PLASTIC MOULD TECHNOLOGY
STAFF STRUCTURE

Intake of the Course 60
Pattern of the Course System 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 Common with other discipline
6.	Lecturer in Chemistry	1	
7.	Lecturer in Physics	1	
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" in 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) including kitchen & store	45 Sqm.

[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-stics 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

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

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

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 1 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

PLASTIC PROCESSING LAB-I & II

Sr.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Hand injection moulding Machine With heaters and Temp. controllers.	3	10000	30000 (15gm/20gm./25gm.)
2.	Hand blow moulding machine (15gm./30gm.)	2 nos.each	10000	40000
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 IV exam. in the 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.----------

-

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----------
---------- ----------

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

Theory ----------Practical----------
---------- ----------
---------- ----------

19. Kindly state whether your organisation Yes/ No
can contribute towards improvement of
Curriculum in above field.
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)