


<div> MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI</div> <div>TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES</div>																	
COURSE NAME : DIPLOMA IN PLASTIC ENGINEERING																	
COURSE CODE : PS																	
DURATION OF COURSE : 6 SEMESTERS										WITH EFFECT FROM 2012-13							
SEMESTER : FIFTH										DURATION : 16 WEEKS							
PATTERN : FULL TIME - SEMESTER										SCHEME : G							
SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME										SW (17500)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min		
1	Testing of Plastics	TOP	17548	03	--	02	03	100	40	50#	20	--	--	25@	10	50	
2	Design of Moulds	DMD	17549	04	--	02	03	100	40	--	--	--	--	25@	10		
3	Plastic Processing-II	PPP	17550	04	--	02	03	100	40	--	--	25#	10	25@	10		
4	Measurement and Control	MCO	17551	03	--	02	03	100	40	--	--	--	--	25@	10		
5	Hydraulics & Pneumatics (PS)	HPN	17552	04	--	02	03	100	40	--	--	--	--	25@	10		
6	Behavioural Science \$	BSC	17075	01	--	02	--	--	--	--	--	25#	10	25@	10		
7	Professional Practices-III	PPS	17072	--	--	03	--	--	--	--	--	--	--	50@	20		
TOTAL				19	--	15	--	500	--	50	--	50	--	200	--	50	
Student Contact Hours Per Week: 34 Hrs.																	
THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.																	
Total Marks: 850																	
@ - Internal Assessment, # - External Assessment, <div></div> No Theory Examination, \$ - Common to all branches, #* - Online Examination,																	
Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.																	
➤ Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).																	
➤ Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.																	
➤ Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.																	

**Course Name : Diploma in Plastic Engineering****Course code : PS****Semester : Fifth****Subject Title : Testing of Plastics****Subject Code : 17548****Teaching and Examination Scheme:**

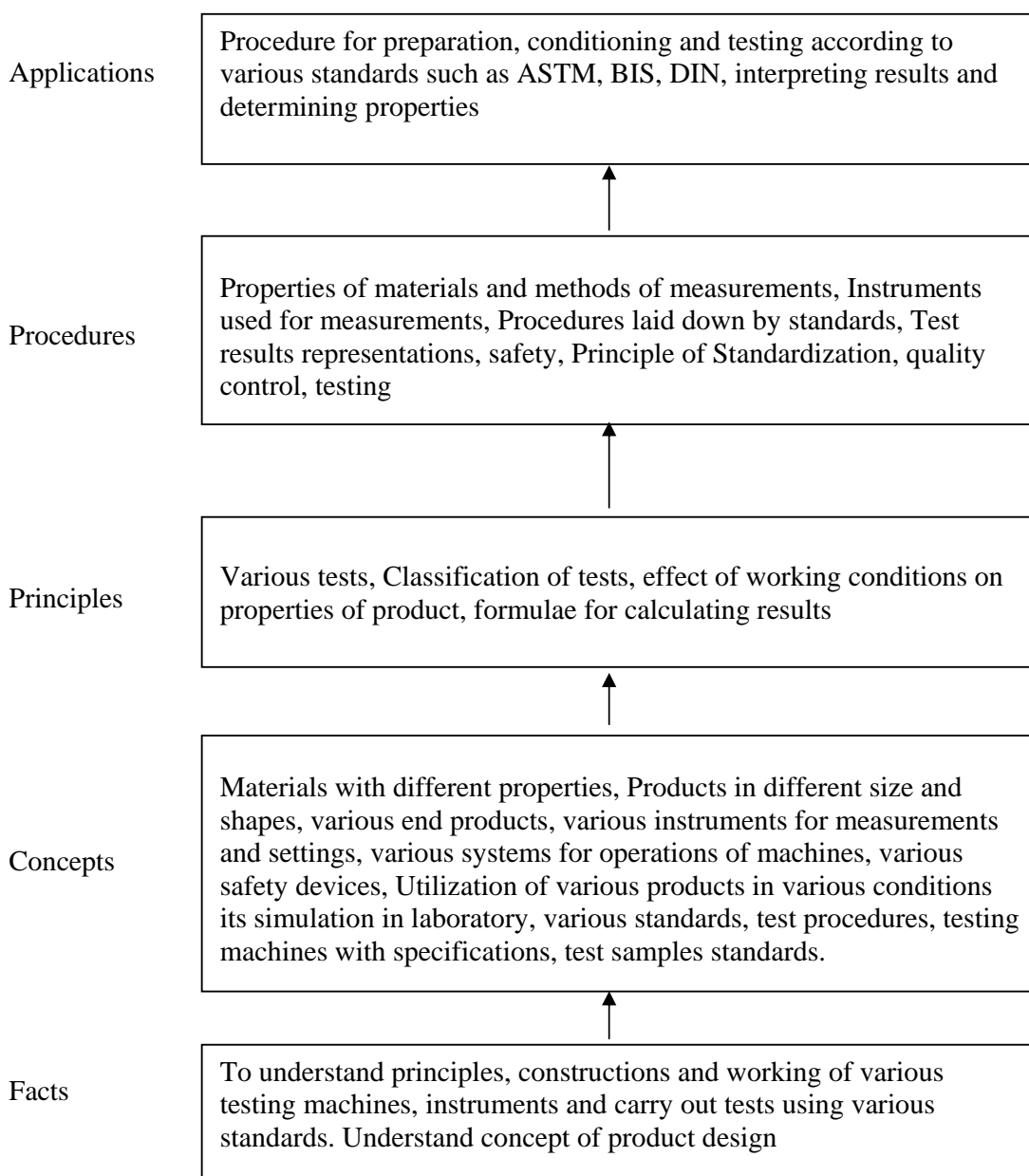
Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	50#	--	25@	175

**NOTE:**

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

**Rationale:**

The use of plastics in every field of life is increasing day by day .So the performance of plastics in the end should be competent enough to prevent part or product failure .This course acquire a basic knowledge of the testing of plastic with the advent of science and Technology .The concept of testing is an integral part of the research and development, product design and manufacturing. This course gives the relevant knowledge of every testing procedure, significance & test results interpretation.

**Learning Structure:**

**Theory:**

Topic and Contents	Hours	Marks
<b>Topic 1: Introduction</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ What is testing</li> <li>➤ Why testing is needed</li> <li>➤ What is specification &amp; standards</li> </ul> Contents: <p>1.1 The need &amp; important of testing -----</p> <ul style="list-style-type: none"> <li>• Actual field testing</li> <li>• Assessment of properties of finished product in relation with service requirements.</li> </ul> <p>1.2 Specification and Standards</p> <ul style="list-style-type: none"> <li>• Importance of specifications</li> <li>• National &amp; international standards for testing</li> <li>• American standards for testing Material(ASTM), international standards organization(ISO),international standards(IS), Bureau of Indian standards(BIS) with their function</li> </ul> <p>1.3 Physical Properties</p> <ul style="list-style-type: none"> <li>• Dimesions, density, specific gravity, bulk density, shrinkage</li> </ul>	04	08
<b>Topics 2: Mechanical Properties &amp; Test Methods</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ How material are classified on basic of Stress-strain curve</li> <li>➤ What is significances of mechanical properties w.r. to plastic product.</li> </ul> Contents: <p>2.1 Introduction,</p> <ul style="list-style-type: none"> <li>• General stress strain curve</li> <li>• Stress- strain curve for different plastic materials,</li> <li>• Standards test methods including test specimen, instrument, procedure along with factor affecting the following tests</li> <li>• Tensile test, flexural test, compression test, impact tests, Hardness test (shore &amp; Rockwell), abrasion test, creep properties &amp; stress relaxation. Significances of creep &amp; stress relaxation</li> </ul>	08	16
<b>Topic 3: Thermal properties &amp; test methods</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ Describe the HDT test with neat sketch</li> <li>➤ What is importance of thermal conductivity while design plastic product</li> </ul> Standard test methods including test specimen, instruments, procedure & factors affecting the following test <p>3.1 Heat deflection temperature(HDT),</p> <p>3.2 Vicat softening point(VSP),</p> <p>3.3 Brittleness temperature,</p> <p>3.4 Thermal conductivity</p>	04	08

<b>Topic 4: Optical Properties &amp; Test Methods</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ How to measure refractive index of plastic material</li> <li>➤ Differentiate between Haze &amp; Gloss</li> <li>➤ Standard test methods including test specimen, instruments, procedure</li> </ul> 4.1 Haze 4.2 Gloss 4.3 Luminous Transperencey 4.4 Refractive Index	06	12
<b>Topic 5: Electrical Properties &amp; Test Methods</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ How to measure Dielectric strength of plastic material</li> <li>➤ List &amp; explain factor affecting dielectric constant of plastic material</li> </ul> Standard test methods including test specimen, instruments, procedure & factors affecting the following test 5.1 Dielectric strength 5.2 Dielectric constant 5.3 Dissipation factor 5.4 Surface & Volume Resistivity 5.5 Arc resistances	08	16
<b>Topic 6: Chemical &amp; Weathering Properties &amp; Test Methods EI</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ How to measure environmental stress-cracking resistances</li> <li>➤ What is effect various organism on the plastic material</li> </ul> 6.1 Stain resistances of plastic material 6.2 Environmental stress crack resistances(ESCR), 6.3 Introduction to various type of test- accelerated outdoor tests, procedure of exposure of plastic to UV lamp, 6.4 Carbon arc lamp, 6.5 Xenon Arc lamp, 6.6 Procedure of exposure of plastic to various fungi, bacteria & sunlight	08	16
<b>Topic 7: Flammability &amp; Rheological test</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ What is underwriter Laboratory test</li> <li>➤ Explain with neat sketch MFI test.</li> <li>➤ What is effect various organism on the plastic material</li> </ul> Flammability-type of burning(vertical & horizontal), oxygen index, underwriter laboratories and melt flow index test, spiral mold test for thermoset, cup test for thermoset	06	16
<b>Topic 8:</b> Thermogravimetric analysis, introduction to DSC & TGA Specific test- burst test(hydrostatic test) for rigid pipes Aceton immersion test.	04	08
<b>Total</b>	<b>48</b>	<b>100</b>

**Practical:****Skills to be developed:****A. Intellectual Skill**

1. Select Test method as per properties of plastics such as mechanical, electrical, Thermal, optical, chemical & flow properties.
2. Interpret the test results.
3. Elaborate the various specialized test techniques as per requirement.

**B. Motor Skills**

1. Perform on line testing of product.
2. Carry out various tests as per standard.
3. Preparation & conditioning of sample.
4. Awareness of industrial testing methods.

**List of Practicals:**

1. To determine hardness of plastic material using Shore hardness tester.
2. To determine abrasion resistances of given plastic material using Taber abrasion.
3. To determine impact test of plastic film using Dart Impact Tester.
4. To determine dilute solution viscosity of polymer using Ostwal viscometer.
5. To determine filler content using muffle furnaces.
6. To measure melt flow index of given plastic material.
7. To determine water absorption of plastic product.
8. Demonstrate tensile test measurement method.
9. Demonstrate to impact test measurement method.
10. To demonstrate thermal analysis technique of measurements.
11. To demonstrate compression strength measurement method.

**Learning Resources:****Books:**

Sr. No.	Author	Title	Publisher
1	Vishu Shah	Hand book of Testing	John willey & sons
2	Brown	Hand book of Testing, Vol. I & Vol. II	Chapman & hall

**Course Name : Diploma in Plastic Engineering****Course Code : PS****Semester : Fifth****Subject Title : Design of Moulds****Subject Code : 17549****Teaching and Examination Scheme:**

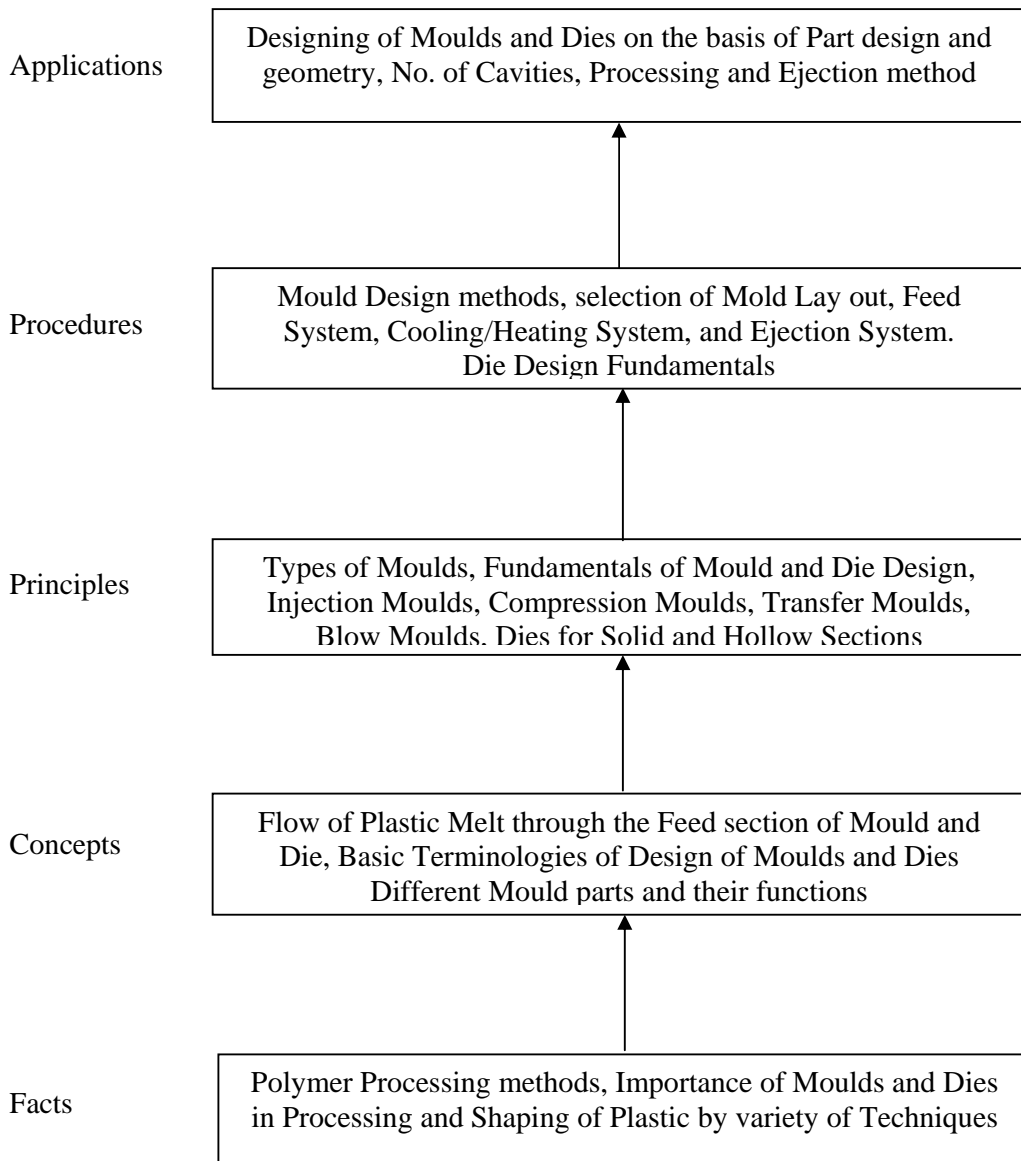
Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

**NOTE:**

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

**Rationale:**

The function of mould is twofold imparting desired shape to plasticized plastic and cooling the molded part. The course exactly gives knowledge of the basic features of drawing, construction and design of moulds like injection Mold. The knowledge & skill of this course gives the idea about ejection, cooling, design of feed system of various moulds which will help in designing, maintaining plastic moulds in plastic industries.

**Learning Structure:**



**Theory:**

Topic and Contents	Hours	Marks
<b>Topic 1: Revision of Injection Mold</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ List different component of two plate mold &amp; write function</li> <li>➤ What is split mold explain the purpose of split mold</li> </ul> 1.1 Different component of two plate injection mold ( core, cavity, runner, type of runners, gates, types of gate, locating ring) 1.2 Complicated mold product such as connector, pipe fitting 1.3 Introduction to split mold	10	16
<b>Topics 2: Split Mold</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ Discuss selection criteria of split mold</li> <li>➤ Explain with neat sketch dog leg cam mechanism</li> </ul> Contents:           2.1 Selection of split mold 2.2 Types of mechanism used to operate split 2.3 Finger cam method 2.4 Dog- leg cam and track actuation methods. 2.5 Angle lift methods 2.6 Actuation methods like spring actuation, hydraulic actuation 2.7 Side core & side cavity	10	20
<b>Topic: 3 Mold for threaded components</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ Draw sketch of different type of thread</li> <li>➤ What are different mechanisms of unscrewing</li> </ul> 3.1 Types of thread, internal & external thread 3.2 Mold for internally threaded design 3.3 Unscrewing mold, impression, layout etc	10	14
<b>Topic: 4 Three Plate Mold</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ What is three plate mold.</li> <li>➤ Differentiate between three plate &amp; two plate mold</li> </ul> 4.1 What is necessity of three plate mold 4.2 Differentiate between three plate & two plate mold 4.3 Brief about runner plate design 4.4 different design aspect of three plate mold 4.5 single and multicavity mold with different gating system	12	20
<b>5 Compression Moulds &amp; Transfer Moulds:</b> 5.1 Description and constructional details of positive, semi positive and flash moulds. 5.2 Description and constructional details of integral pot, and auxiliary ram type transfer mould. 5.3 Comparison of compression and transfer moulds	12	16

<b>Topic: .6 Mold Material and Heat Treatment</b> Specific Objectives: ➤ Classify mold material ➤ What is heat treatment? why it is necessary ➤ 6.1 Classification of mold material 6.2 Heat treatment of steel 6.3 Surface treatment like Harding and nitrating 6.4 Chrome plating 6.5 Nickel plating 6.6 Polishing		
	10	14
	<b>Total</b>	<b>64 100</b>

**Practical:****A. Intellectual Skill**

1. Understand different types of operation of moulds.
2. Selection of different types of ejection, cooling.
3. Selection of feed system elements.
4. Understand types of dies.
5. Selection of die / mould for particular products.

**B. Motor Skills**

1. Ability to prepare the drawing.
2. Ability to select moulds.
3. Develop skill of sequencing different mould parts.
4. Develop skill to measure the dimensions of mould /die.

**List of Practicals:**

1. Draw sketch of two plate mold with specific gate
2. Draw sketch of two plate spilt mold
3. Draw sketch of threaded article
4. Draw sketch of compression mold
5. Industrial drawing discussed (Interprete)

**Learning Resources:****Books:**

Sr. No.	Author	Title	Publisher
1	Injection Mould Design	R.W. Pye	Hanser
2	Plastic Mould Design	By R.H. Beeb	Hanser
3	Hand Book of Blow Moulding	Rosato	Hanser
4	Hand Book of Injection Molding	Rosato	Hanser
5	Extrusion Dies	M.V. Joshi	McMillan India
6	Spi Plastic Engineering Handbook	Michael L. Berino	Chapman & Hall
7	Plastic Mould Design Handbook	Dubois and Pribble	Rockport
8	Mould Engineering	By Herbert Rees	Hanser
9	Plastics Extrusion Tech. Handbook	Sidney Levy, P.E.	Hanser
10	Injection Moulds II Edition.	Gastrow	Chapman & Hall
11	Handbook Of Mould Design	Mennings	Hanser

**Course Name** : Diploma in Plastics Engineering  
**Course Code** : PS  
**Semester** : Fifth  
**Subject Title** : Plastics Processing-II  
**Subject Code** : 17550

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25#	25@	150

**NOTE:**

- Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.
- Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).

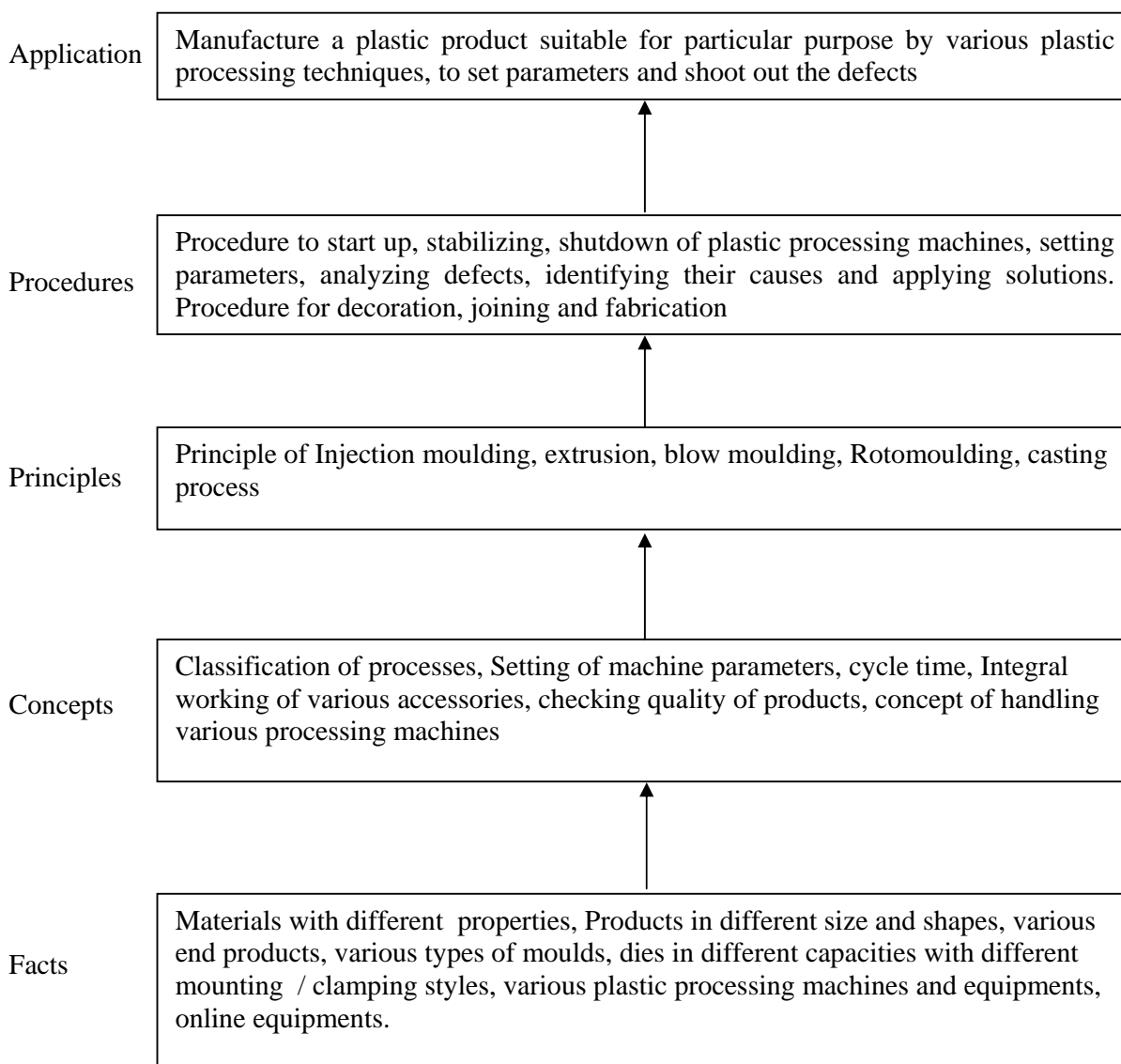
**Rationale:**

Whether we want to make a toy or fabricate a spacecraft, polymers would often have crucial role to play. But how does one convert a polymer into a broad spectrum of useful shapes and structures? To answer this question we need to look at another branch of Plastic Engineering called “Polymer Processing” which is the theme of this subject. Processing of plastic defined as an engineering speciality used to convert polymeric materials into useful end products.

**General Objectives:**

The student will be able to:

1. Understand the principle of injection moulding, extrusion, blow moulding.
2. Understand the basic concepts of operation and handling of process machines.

**Learning Structure:**

**CONTENTS: Theory**

Topic No.	Name of the topic	Hrs.	Marks
1	<p><b>The student should be able to</b></p> <ul style="list-style-type: none"> <li>➤ Know the rotational moulding process</li> <li>➤ Analyse the practical significance of rotational moulding</li> </ul> <p><b>Rotational Moulding:</b></p> <p>1.1 Basic process – diagram, principle, steps of rotomolding process, and its description.</p> <p>1.2 Types of materials used in rotomolding process - purpose of pulverised materials</p> <p>1.3 Types of rotational moulding machines -</p> <ul style="list-style-type: none"> <li>i) Batch type - diagram, working.</li> <li>ii) Independent arm type m/c- diagram, construction</li> <li>iii) Straight - line m/c- construction</li> <li>iv) Jacketed mold machine- construction, advantages and disadvantages of m/c.</li> <li>v) Carousel type m/c - diagram, working</li> </ul> <p>1.4 Merits and demerits of rotational moulding process</p> <p>1.5 Types of Heating and cooling systems – mode of heat transfer, water, air and oil heating and cooling.</p> <p>1.6 Trouble shooting guide for rotomolding.</p>	10	14
2.	<p><b>The student should be able to</b></p> <ul style="list-style-type: none"> <li>➤ Know the process of compression moulding</li> <li>➤ Acquire the skill of identifying the art of compression moulding</li> </ul> <p><b>Compression Molding :</b></p> <p>2.1 Basic process - diagram, steps in compression moulding.</p> <p>2.2 Types of machines</p> <ul style="list-style-type: none"> <li>hand operated - construction</li> <li>automatic compression moulding - description, applicability</li> </ul> <p>up-stroking m/c - diagram, construction, down stroking m/c - diagram, construction.</p> <p>2.3 preheating and types of preheating - automatic screw preplasticating, infrared, and high frequency preheating, their description, process, cure time comparisons.</p> <p>2.4 Outgassing- cause, description and advantages.</p> <p>2.5 Postcuring – cause and action</p> <p>2.6 Advantages and limitations of compression molding.</p> <p>2.7 Moulding compounds or materials used in compression moulding-</p> <ul style="list-style-type: none"> <li>i) Thermoset – PF, MF, UF, epoxy, unsaturated polyester</li> <li>ii) Sheet moulding compound and dough moulding compounds</li> <li>iii) Thermoplastics</li> </ul> <p>2.8 Trouble shooting guide in compression moulding.</p>	10	14
3	<b>The student should be able to</b>	08	12

	<ul style="list-style-type: none"> <li>➤ Know the transfer moulding process</li> <li>➤ Analyse the practical significance of transfer moulding.</li> </ul> <p><b>Transfer Moulding:</b></p> <p>3.1 Basic process – Diagram, working</p> <p>3.2 Types of transfer moulding</p> <ul style="list-style-type: none"> <li>i) Pot type transfer m/c – diagram, working</li> <li>ii) Plunger type transfer m/c- diagram, working</li> <li>iii) Screw type transfer m/c- diagram, working</li> </ul> <p>3.3 Advantages of transfer moulding –moulding cycle, tool and maintenance cost, moulding tolerances, finishing costs.</p> <p>3.4 Limitations of transfer moulding- mould costs, loss of material, effect on mechanical strength.</p> <p>3.5 Comparison between compression and transfer moulding – loading the mould, material temperature before moulding, pressure in the cavity, breathing the mould, cure time, moulding temperature, tolerances on finished product, shrinkage.</p> <p>3.6 Trouble shooting guide.</p>		
4	<p><b>The student should be able to</b></p> <ul style="list-style-type: none"> <li>➤ Acquire skill of identifying the art of calendaring process.</li> <li>➤ Analyse practical significance of calendaring.</li> <li>➤ Describe configuration of calendaring.</li> <li>➤ Optimize the process of calendaring.</li> </ul> <p><b>Calendering:</b></p> <p>Definition of calendaring</p> <p>4.2 Basic process – new calendar train diagram, working.</p> <p>4.3 Blending- Principle, types of blenders, such as high speed blending and ribbon blending, their comparison and working of blenders.</p> <p>4.4 Scrap and cold trim handling</p> <p>4.5 Mills and strainers – construction and working</p> <p>4.6 Calender units – types of calendar units, their comparison, constructional features.</p> <p>4.7 Take off stripper section - construction and working</p> <p>4.8 Embosser - constructional features, working. Materials used for calendaring</p> <p>4.10 Applications of calendered films or sheets</p> <p>4.11 Comparison between calendaring and extrusion</p> <p>4.12 Trouble shooting guide in calendaring.</p>	12	20
5	<p><b>Fabrication With Plastics:</b></p> <p>The student should be able to</p> <ul style="list-style-type: none"> <li>➤ Know the basic processes and purpose of fabrication with plastic</li> <li>➤ Analyse the practical significance of fabrication</li> <li>➤ Acquire skill of identifying the art of fabrication</li> </ul> <p><b>Fabrication with Plastics:</b></p> <p>5.1 Purpose of finishing</p> <p>5.2 Types of finishing - filing, grinding and sanding, ashing, buffing and polishing</p> <ul style="list-style-type: none"> <li>i) Filing – purpose of filing, selection of file, filing of thermoplastics, filing thermosetting plastics.</li> <li>ii) Grinding and sanding – sanding of various thermoplastics such</li> </ul>	12	20

	<p>as acrylic, PS, ABS, acetals, PC.</p> <p>iii) Ashing, buffing and polishing of thermoplastics such as ABS, acetal and styrene. And thermosetting plastics.</p> <p>5.3 Solvent cementing of thermoplastics- advantages, methods of solvent cementing, precautions.</p> <p>5.4 Adhesive bonding of plastics – types of cements – solvent, dope and monomeric or polymerisable cements, method of joining of plastics, general rules to be observed in cementing of plastics, joint designs such as lap joint, butt joint, tongue joint, groove joint and V- joint.</p> <p>5.5 Welding Techniques- Definition of welding, principle of welding, classification of welding, welding techniques –</p> <p>i) High frequency or dielectric heat sealing- working, materials to be joined, applications.</p> <p>ii) Hot gas welding – diagrams of joints, description of the process, materials to be joined, applications,</p> <p>iii) Hot plate welding- diagram, description of the process, materials to be joined, applications, advantages, and disadvantages.</p> <p>iv) Induction welding- diagram, description materials to be joined, applications, advantages, and disadvantages.</p> <p>v) Spin or friction welding- diagram, description, advantages, limitations, materials, applications.</p> <p>vi) Ultrasonic assembly- diagram, description, applications, materials, advantages and limitations.</p>		
6	<p><b>Decorating Plastics:</b>  <b>The student should be able to</b></p> <ul style="list-style-type: none"> <li>➤ Know the basic processes and purpose of decorating with plastics</li> <li>➤ Distinguish product wise application of each process of decorating with plastics</li> <li>➤ Know the practical significance of each decorating technique.</li> </ul> <p><b>Decorating Plastics:</b></p> <p>6.1 Purpose of surface treatment</p> <p>6.2 Techniques of surface treatment</p> <p>i) Washing,</p> <p>ii) Solvent Cleaning</p> <p>iii) Flame Treatment</p> <p>iv) Corona Discharge</p> <p>6.3 Printing- principle, diagram, working, advantages and limitations of flexographic printing, screen printing, gravure printing and pad printing</p> <p>6.4 Labels and decals- description of the process.</p> <p>6.5 Hot transfer processes- description, advantages and limitations</p> <p>6.6 Electrolytic plating- principle, description, type of materials used.</p> <p>6.7 Vacuum metallizing- diagram and description of the process.</p> <p>6.8 Electroless plating- description of the process</p> <p>6.9 Special techniques-</p> <p>i) Laser marking- Description</p> <p>ii) Dyeing- description</p> <p>iii) Flocking- diagram, description of the process.</p>	12	20
<b>Total</b>		<b>64</b>	<b>100</b>

**List of Practicals:****A. Intellectual Skills**

1. Selection of processing machine.
2. Trouble shooting in machine during processing.
3. Identify the various parts of processing machine.
4. Improve the aesthetic appearance of plastics product.
5. Analysis & solving of defects in the product.
6. Select appropriate decorating technique.
7. Select suitable joining / welding process.

**B. Motor Skills**

1. Operate the machine systematically.
2. Loading and unloading of dies.
3. Decorating plastics.
4. Joining plastics by various methods.
5. Measuring quantity of raw materials.
6. Checking product dimensions.

**List of Practicals:**

1. Joining of plastics by solvent cementing process.
2. Demonstration of joining of plastics by hot plate welding / adhesives.
3. Demonstration of decoration of plastics by hot stamping machine.
4. Demonstration of decoration of plastics by screen printing.
5. Demonstration of compression moulding process.
6. Demonstration of rotational moulding process.
7. Demonstration of transfer moulding process.
8. Collect the data and specifications of rotational moulding m/c (case study)
9. Collect the different samples of printed films and predict the possible method of printing use. (case study)
10. Compare the vacuum metallizing techniques with electroplating techniques. List any two product of each process.
11. Prepare the list of thermosetting materials and their processing parameter with respect to compression and transfer moulding.
12. Compare various techniques of printing such as flexographic, pad printing, screen printing w.r.t. materials, product, process etc. (case study)

**Learning Resources:****Books:**

Sr. No.	Title	Author	Publisher
1	Polymer Extrusion	Chris Rauwandaal	Hanser
2	Plastic Extrusion technology	Hensen	Hanser
3	SPI Plastic Engg. Handbook	Berino	--



4	Polymer Extrusion	Grifth	--
5	Decorating Plastics	Margolis	Hanser
6	Encyclopedia of Polymer Science	--	--
7	Handbook of Foam Technology	--	--
8	Plastics extrusion tech. handbook	Sidney Levy P.E	Industrial Press
9	Extruder principles & operation-II Edition	Stevens & Coras	Chapman & hall
10	Handbook of Plastics Technology, volume I and Volume-II	W. S. Allen and P. N. Backer	CBS Publishers and distributers, New Delhi.
11	Practical Guide to Rotational Moulding	R. J. Crawford and M. P. Kearns	Rapra Technology Ltd.,UK.
12	Plastics processing	Brent Strong	Hanser

**Course Name** : Diploma in Plastics Engineering  
**Course Code** : PS  
**Semester** : Fifth  
**Subject Title** : Measurements and Control  
**Subject Code** : 17551

**Teaching and Examination Scheme:**

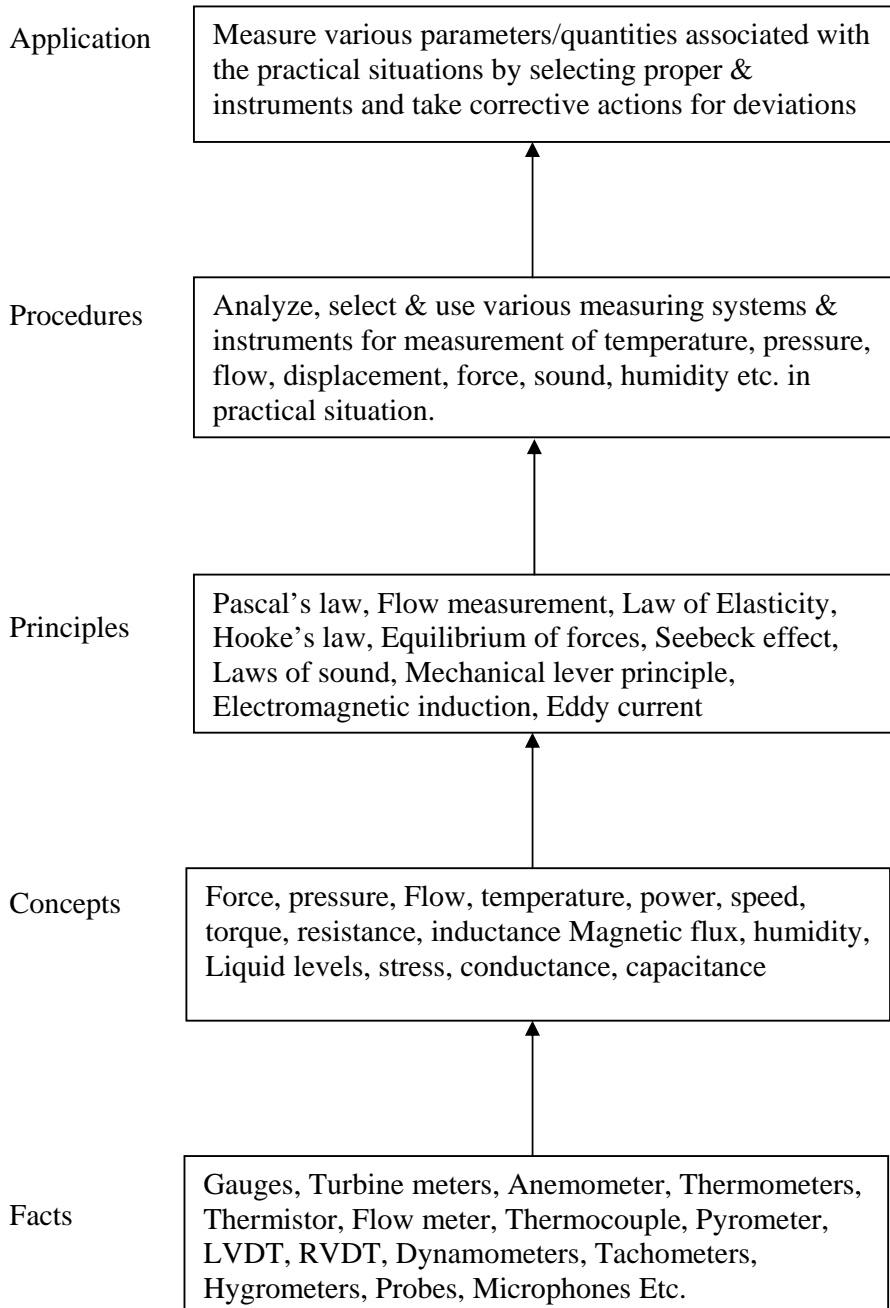
Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

**NOTE:**

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**Rationale:**

The art of measurement plays an important role in all branches of engineering. With advances in technology, measurement techniques have also taken rapid strides, with many types of instrumentation devices, innovations, refinements. The course aims at making a Mechanical Engineering student familiar with the principles of instrumentation, transducers & measurement of non electrical parameters like temperature, pressure, flow, speed, force and stress and methods of control systems for engineering applications.

**Learning Structure:****Contents: Theory**

Topic and content	Hours	Marks
<b>1: Introduction and Significance of Measurement</b>  <b>Specific objectives-</b> The students will be able to understand <ul style="list-style-type: none"> <li>➤ Terminology related to measurement</li> <li>➤ Various types of errors</li> <li>➤ Concept of transducers</li> </ul> <b>Contents:</b> <b>1.1 Types of measurement, classification of instruments</b> <b>Static terms and characteristics-</b> Range and Span, Accuracy and Precision, Reliability, Calibration, Hysteresis and Dead zone, Drift, Sensitivity, Threshold and Resolution, Repeatability and Reproducibility, Linearity. <b>1.2 Dynamic characteristics-</b> Speed of response, Fidelity and Dynamic errors, Overshoot. 06 Marks <b>1.3 Measurement of error-</b> Classification of errors, environmental errors, signal transmission errors, observation errors, operational errors. 04 Marks <b>1.4 Transducers :</b> Classification of transducers, active and passive, resistive, inductive, capacitive, piezo-resistive, thermo resistive 08 Marks	08	18
<b>2: Displacement and Pressure Measurement</b> <b>Specific Objectives</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Explain working of displacement transducers</li> <li>➤ Explain construction and working of low pressure and high pressure measuring instruments.</li> </ul> <b>Contents:</b> <b>2.1 Displacement Measurement</b> 08 Marks Capacitive transducer, Potentiometer, LVDT, RVDT, Specification, selection & application of displacement transducer. Optical measurement scale and encoders <b>2.2 Pressure Measurement</b> 10 Marks <ul style="list-style-type: none"> <li>➤ <b>Low pressure gauges-</b> McLeod Gauge, Thermal conductivity gauge, Ionization gauge, Thermocouple vacuum gauge, Pirani gauge.</li> <li>➤ <b>High Pressure gauge-</b> Diaphragm, Bellows, Bourdon tube, Electrical resistance type, Photoelectric pressure transducers, piezoelectric type, Variable capacitor type</li> </ul>	10	18
<b>3: Temperature measurement</b> <b>Specific objectives-</b> The students will be able to <ul style="list-style-type: none"> <li>➤ Explain electrical and non electrical methods of temperature measurements</li> <li>➤ Describe high temperature measuring instruments such as pyrometers</li> </ul> <b>Content:</b> <b>3.1 Non-Electrical Methods-</b> Bimetal, Liquid in glass thermometer and Pressure thermometer <b>3.2 Electrical Methods-</b> RTD, Platinum resistance thermometer,	06	16

<p>Thermistor, Thermoelectric methods - elements of thermocouple, Seebeck series, law of intermediate temperature, law of intermediate metals, thermo emf measurement. 08 Marks</p> <p>3.3 <b>Pyrometers</b>- radiation and optical</p>		
<p><b>4 : Flow Measurements</b> <b>Specific objectives-</b> The students will be able to</p> <ul style="list-style-type: none"> <li>➤ Describe variable area, variable velocity flow meters</li> <li>➤ Special flow meters-electro-magnetic and ultrasonic flow meter</li> </ul> <p><b>Content :</b> 4.1 <b>Variable area meter</b>-Rota meter, Variable velocity meter- Anemometer 06 Marks 4.2 <b>Special flow meter</b>- Hot wire anemometer, Electromagnetic flow meter, Ultrasonic flow meter ,Turbine meter ,Vortex shedding flow meter 06 Marks</p>	06	12
<p><b>5 : Miscellaneous Measurement</b> <b>Specific objectives-</b> The students will be able to</p> <ul style="list-style-type: none"> <li>➤ Explain characteristic of sound and Measurement of sound intensity</li> <li>➤ Measure shaft power</li> <li>➤ Describe contact and non contact type of speed measuring instruments</li> <li>➤ Explain working of strain gauges</li> </ul> <p><b>Content :</b> 5.1 Introduction to sound measurement and study of Electro dynamic microphone and Carbon microphone. 5.2 <b>Humidity measurement</b> –Hair hygrometer, Sling psychrometer, 5.3 <b>Liquid level measurement</b> – direct and indirect methods. 5.4 <b>Force &amp; Shaft power measurement</b> -Tool Dynamometer (Mechanical Type), Eddy Current Dynamometer, Strain Gauge Transmission Dynamometer. 5.5 <b>Speed measurement</b> -Eddy current generation type tachometer, incremental and absolute type, Mechanical Tachometers, Revolution counter &amp; timer, Slipping Clutch Tachometer, Electrical Tachometers, Contact less Electrical tachometer, Inductive Pick Up, Capacitive Pick Up, Stroboscope 5.6 <b>Strain Measurement</b>-Stress-strain relation, types of strain gauges, strain gauge materials, resistance strain gauge- bonded and unbounded, types(foil, semiconductor, wire wound gauges), selection and installation of strain gauges load cells, rosettes.</p>	08	16

<b>6 : Control systems</b>		
<b>Specific objectives-</b> The students will be able to		
<ul style="list-style-type: none"> <li>➤ Know various types of control systems and their comparison</li> <li>➤ State field applications of control systems</li> </ul>		
<b>Contents:</b>		
6.1 Block diagram of automatic control system, closed loop system, open loop system, feed back control system, feed forward control system, servomotor mechanism, 06 Marks	10	20
6.2 Comparison of hydraulic, pneumatic, electronic control systems, 06 Marks		
6.3 Control action: Proportional, Integral, derivative, PI,PD, PID 04 Marks		
6.4 Applications of measurements and control for setup for boilers, air conditioners, motor speed control 04 Marks		
<b>Total</b>	<b>48</b>	<b>100</b>

Note-i) Simple numerical on chapter 1,4,5

ii) No numerical on chapter 2,3,6

#### **Practical:**

Skills to be developed:

#### **Intellectual Skills:**

1. Analyze the result of calibration of thermister
2. Interpret calibration curve of a rotameter
3. Evaluate the stress induced in a strain gauge
4. Verify the characteristics of photo transistor and photo diode

#### **Motor Skills:**

1. Test and calibration of a thermocouple
2. Handle various instruments
3. Draw the calibration curves of rotameter and thermister
4. Measure various parameters using instruments

#### **List of Practical:**

1. Understand the methods of measurements and instrument characteristics with illustration
2. Displacement measurement by inductive transducer.( LVDT)
3. Measurement of negative pressure using McLeod gauge / Bourdon tube pressure gauge
4. Measurement of temperature by using Thermocouple.
5. Measurement of flow by using rotameter.
6. Measurement of strain by using a basic strain gauge and hence verify the stress induced.
7. Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up.
8. Measurement of force & weight by using a load cell.
9. Liquid Level Measurement by using Capacitive Transducer system.
10. Study of control system with one suitable application (boiler) arranging industrial visit at sugar factory / paper mill / textiles / food processing industry.
11. Mini project-A group of 4 students shall take a mini project of searching information about advanced instrumentation / control system using internet and submits its report.

**Learning Resources:****Books:**

<b>Sr. No.</b>	<b>Author</b>	<b>Title</b>	<b>Publication</b>
01	D.S.Kumar	Mechanical Measurements & Control	Metropolitan Publications, New Delhi
02	R.K.Jain	Mechanical & Industrial Measurements	Khanna Publications, New Delhi
03	A.K.Sawhney	Mechanical Measurements & Instrumentation	Dhanpat Rai & Sons, New Delhi.
04	E. O. Doebelin	Measurement Systems	Tata McGraw Hill Publications
05	R.V. Jalgaonkar	Mechanical Measurement & Control	Everest Publishing House, Pune
06	C.S. Narang	Instrumentation Devices & Systems	Tata McGraw Hill Publications
07	B.C.Nakra and K.K.Chaudhary	Instrumentation, Measurement and Analysis	Tata Mc Graw Hill Publication
08	Thomas Beckwith	Mechanical Measurement	Pearson Education
09	James W Dally	Instrumentation for Engg. Measurement	Wiley India

**Course Name : Diploma in Plastics Engineering****Course Code : PS****Semester : Fifth****Subject Title : Hydraulics & Pneumatics****Subject Code : 17552****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25 @	125

**Rationale:**

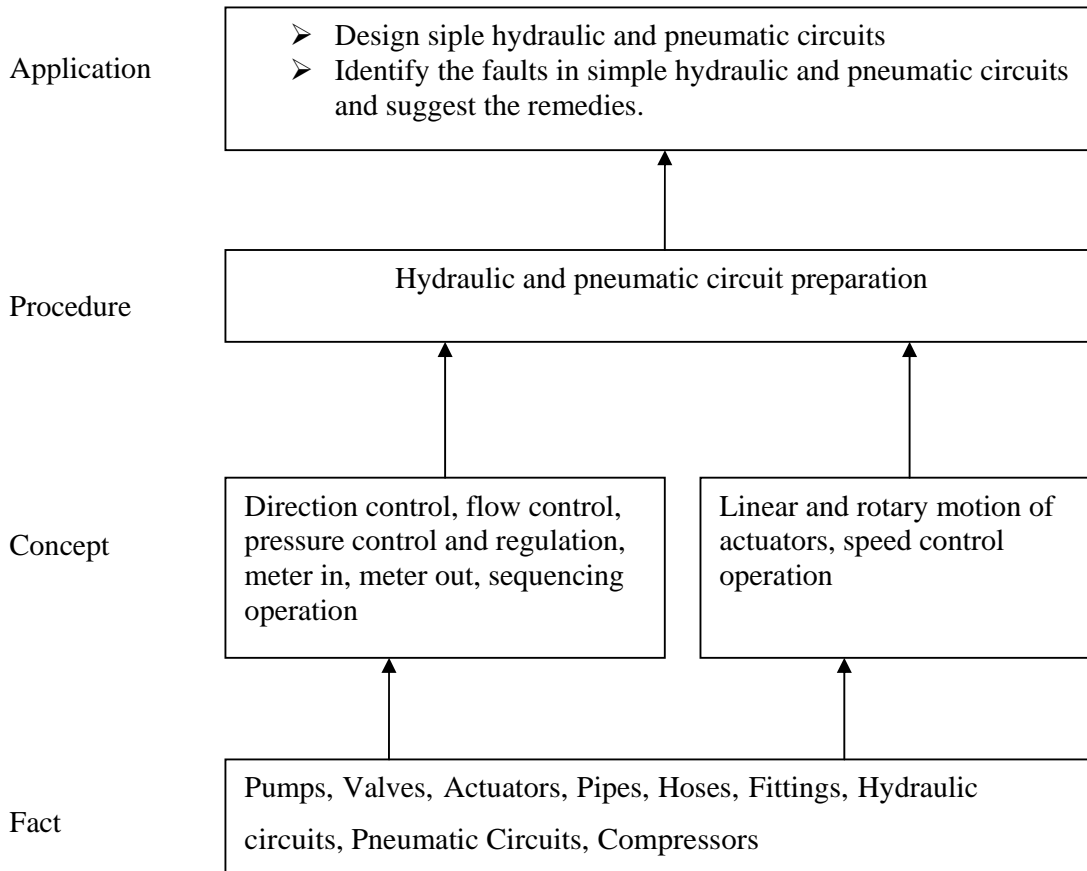
Oil hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids. Diploma engineers come across such systems in all the segments of industries. This subject will give the students, the basic skills and knowledge of oil hydraulics and pneumatics which will be directly needed in the industrial environment.

**General Objectives:**

The student will be able to,

- 1) Identify various components of hydraulic & pneumatic systems.
- 2) Know the working principle of various components used in hydraulic & pneumatic systems.
- 3) Select appropriate components required for simple hydraulic and pneumatic circuits.



**Learning Structure:**

**Theory: Hydraulic & pneumatics**

Topic and Contents	Hours	Marks
<b>Topic 1: Fundamental of Hydraulics</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ Define Fluid</li> <li>➤ State properties of fluid</li> </ul> 1.1 Fluids 1.2 Classification of fluids on basic of viscosity, 1.3 Properties of fluid 1.4 Flow of fluid 1.5 laminar & turbulent flow 1.6 Bernoulli's Theorem & application	07	10
<b>Topics 2: Introduction to Power Hydraulics</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ State Pascal law</li> <li>➤ Write advantage of hydraulic drive</li> </ul> Contents:           2.1 Pressure 2.2 Pascal law 2.3 conservation of energy 2.4 Hydraulic leverage 2.5 Power transmission 2.6 Advantage of hydraulics 2.7 Hydraulic drives 2.8 Hydraulic circuit elements 2.9 Symbols for hydraulic element	10	16
<b>Topic 3: Hydraulic Pipe Fitting and Sealing, Reservoir</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ List type of seal used in hydraulic system</li> <li>➤ Write the purpose of filter.</li> </ul> 3.1 Various pipe fitting , hose 3.2 Seal, type of seal, function of seal 3.3 Seal Material 3.4 Maintenance of pipe fitting 3.5 Reservoir, type & function 3.6 Strainers & filters 3.7 Oil maintenances 3.8 Oil cleaning system	07	10
<b>Topic 4: Power Hydraulic Elements</b> Specific Objectives: <ul style="list-style-type: none"> <li>➤ Draw neat sketch of four way direction control valve</li> <li>➤ Write function of flow control valve</li> </ul> 4.1 Control elements- pressure control valves, function and type(Relief Valve, Pressure reducing Valves, sequence valve, counterbalance valve) 4.2 Direction control valves, function and type(poppet valve, check valve, two way valve & four way valve) 4.3 Flow control valve, function & type(gate , globe valve) 4.4 Actuator- cylinder, motor 4.5 Accessories- accumulator, intensifier	12	20

<b>Topic 5: Pumps &amp; Hydraulic Motor</b> 5.1 Hydraulic motor Gear - Type Motors Vane - Type Motors Piston - type Motors 5.2 Pump Classifications Non Positive - Displacement pumps Positive Displacement pumps Characteristics, performances, Displacement (Fixed-Displacement pump & Variable - Displacement pump) Construction & working of Gear Pump (External, Internal Type, Lobe Pump) Construction & working of Vane pump Characteristics, unbalanced Vane pump, balanced Vane Pump Construction & working of Piston Pump Radial, axial piston pump	14	24
<b>Topic 6: Pneumatic</b> Specific Objectives: ➤ 7.1 Circuit Element and Symbols 7.2 Air compressor 7.3 FRL unit 7.4 Shuttle valves 7.5 Sensing element 7.6 Limit Switch, Proximity Switch 7.7 Actuators- linear, rotary. 7.8 Basic pneumatic circuit used in blow moulding machine. 7.9 Safety requirements	14	20
<b>Total</b>	<b>64</b>	<b>100</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Prepare simple oil hydraulic & pneumatic circuits.
2. Compare the performance of oil hydraulic & pneumatic systems.
3. Identify the faults & suggest remedies in oil hydraulic & pneumatic circuits.
4. Select proper circuit for given application.

**Motor Skills:**

1. Connect different components in oil hydraulic or pneumatic circuit as per given drawing.
2. Perform repairing and / or replacement of defective components in the oil hydraulic or pneumatic circuit.
3. Draw the oil hydraulic and pneumatic circuits using symbols.

**List of Practicals:**

1. To understand piston and cylinder arrangement
2. To understand direction control valve
3. To understand principle of hydraulic pump
4. To understand pressure control valve

5. To understand principle of hydraulic motor
6. To understand hydraulic clamping mechanics of injection molding
7. To understand flow control valve
8. To understand FRL unit principle
9. To understand principle of compressor
10. To understand function of reservoirs, type.
11. To understand limit switch
12. To prepare basic hydraulic and pneumatic circuit.

**Assignments -**

1. Market survey of oils used for oil hydraulic circuits.
2. Study of any one mobile hydraulic system like in earth moving equipments or any one stationary hydraulic system, like in any machine tool and its detailed report.  
(Assignments to be completed in a group of four students.)

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
01	Majumdar S.R	Oil Hydraulic system- Principles and maintenance	Tata McGraw Hill
02	Majumdar S.R	Pneumatics Systems Principles and Maintenance	Tata McGraw Hill
03	Joji B.	Pneumatic Controls	Wiley India Pub.
04	Stewart	Hydraulics and Pneumatics	Taraporewala Publication

**2. Catalogues:**

Various system components' manufacturers' catalogues.

**3. CDs:**

CDs developed by various system components' manufacturers.

**Course Name : All Branches of Diploma in Engineering & Technology**

**Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/EE/EP/CH/PS/CD/ED/EI/CV/FE/FG/IU/MH/MI/TX/TC/DC/AU**

**Semester : Fifth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/EE/EP/CH/PS/AU and Sixth for CD/MH/IU/CV/FE/FG/MI/ED/EI/DC/TC/TX**

**Subject Title : Behavioural Science**

**Subject Code : 17075**

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	--	25 #	25 @	50

#### **Rationale:**

With increased globalization and rapid changing business expectations, employers are looking for wide cluster of skills to cater to the changing demand. Personality traits and soft skills are playing a key role in a student's career in this changing scenario. Corporate houses look for soft skills that supplement hard skills.

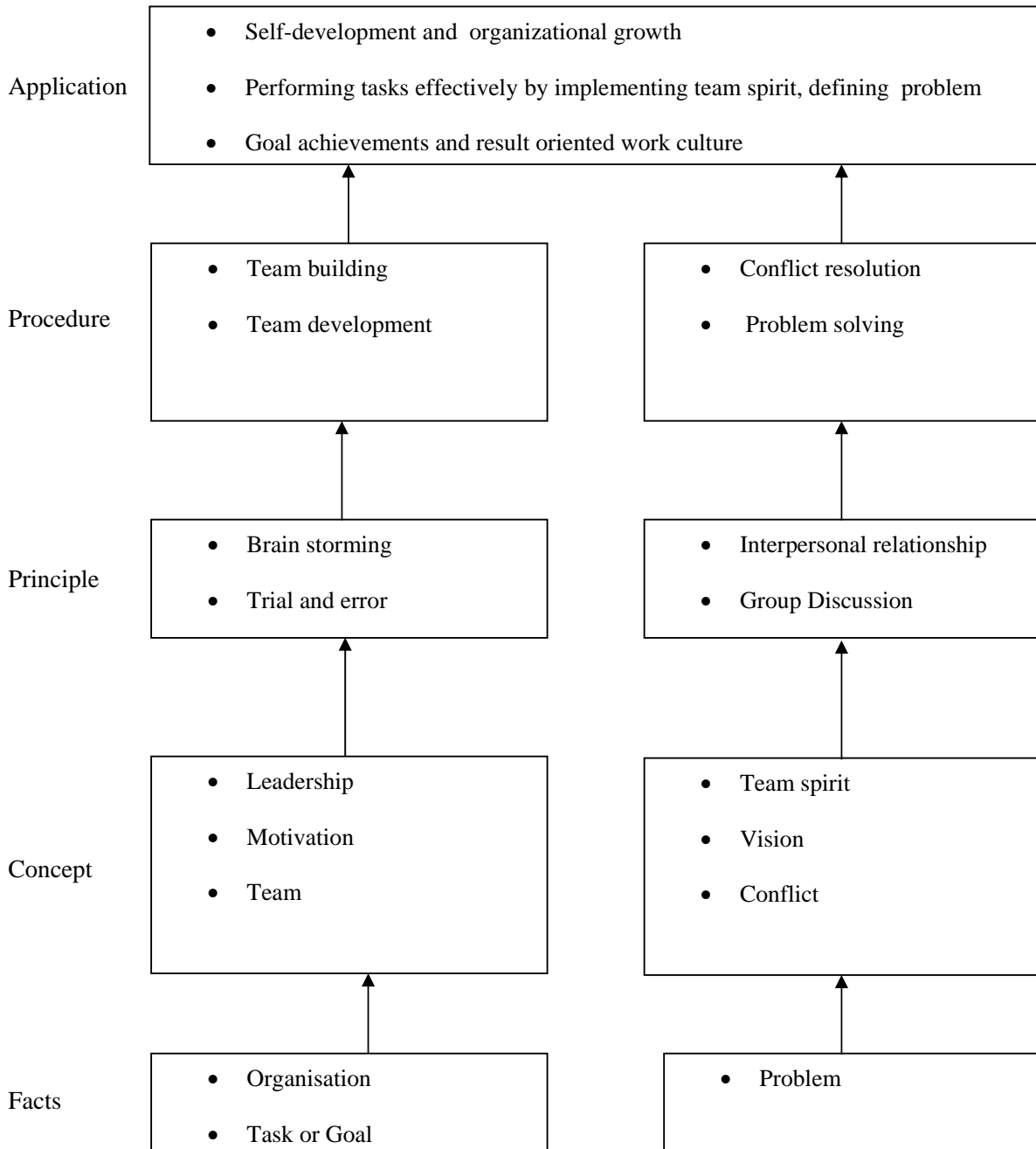
Addition of behavioural science in curriculum is intended to enhance the efficiency of a person so that he can contribute to overall growth of organisation. It aims at developing insight into leadership, team building, motivation, interpersonal relationship, problem solving, decision making and aspects of personality in a technician's profile. Addition of the topic of organizational culture will further mould him/ her in the organisational role.

This subject of 'Behavioural Science' provides a broad base in which a technician can develop a successful career in the world of work.

#### **General Objectives:**

After studying this subject, the students will be able to:

1. Develop him/her as Team leader.
2. Use self-motivation and motivate others.
3. Build a team and develop team spirit among the team members.
4. Improve the interpersonal relationship skills.
5. Learn Problem solving and decision making skills.
6. Discuss a particular topic in a group and face the interview.

**Learning Structure:**

**Theory:**

Topic and Contents	Hours
<b>Topic 1: LEADERSHIP</b> Contents: 1.1 Introduction – Importance, examples of different types of leaders. 1.2 Meaning and Definition of Leadership. 1.3 Leadership qualities – Confidence, Vision, Communication Skills, influencing people etc. 1.4 Types of Leadership styles, their advantages and disadvantages – Autocratic, Democratic, Delegative, Bureaucratic and Laissez Fairie.	02
<b>Topic 2: MOTIVATION</b> Contents: 2.1 Meaning and Definition of motivation. 2.2 Types of motivation. 2.3 Maslow's Motivation theory. 2.4 Job characteristic model to enhance motivation.	03
<b>Topic 3: TEAM BUILDING</b> Contents: 3.1 Definition of Team. 3.2 Difference between Group and Team. 3.3 Need for formation of good team (vision, trust, cooperation, initiative, etc.) 3.4 Approach to Team building (Personality based, activity based, skill based, problem solving based, etc.)	02
<b>Topic 4: CONFLICT RESOLUTION</b> Contents: 4.1 Definition of Conflict. 4.2 Types of Conflict – Functional and Dysfunctional 4.3 Sources of Conflict – Ego, Authority, Frustration etc. 4.4 Positive and Negative effects of conflicts. 4.5 Methods of Conflict resolution – Compromising, withdrawal, forcing.	04
<b>Topic 5: PROBLEM SOLVING AND DECISION MAKING</b> Contents: 5.1 Steps in Problem Solving. 5.2 Methods used for solving problems – trial and error method, brain storming, lateral thinking method. 5.3 Techniques used for Decision making- Decision tree, Decision Matrix, Mind Mapping etc.	03
<b>Topic 6: GROUP DISCUSSION AND INTERVIEW TECHNIQUES</b> Contents: 6.1 GROUP DISCUSSION <ul style="list-style-type: none"> <li>Objectives of Group Discussion (ability to work in team, speaking and listening skills, leadership, creativity)</li> <li>Does and Don'ts of Group Discussion.</li> <li>How to conclude Group Discussion.</li> </ul>	02

6.2 INTERVIEW TECHNIQUES	
<ul style="list-style-type: none"> <li>Types of Interviews. (patterned, stress, behavioural)</li> <li>Dress Code, Body Language and Communication Skill.</li> <li>Probable questions for Interview.</li> <li>Telephonic or Video Interview.</li> </ul>	
<b>Total</b>	<b>16</b>

**Practical:****Skills to be developed:****Intellectual Skills:**

1. Develop ability to find his strengths.
2. Select proper source of information.
3. Follow the technique of time and stress management.
4. Set the goal.

**Motor Skills:**

1. Follow the presentation of body language.
2. Work on internet and search for information.
3. Prepare slides / transparencies for presentation.

**List of Practicals / activities:**

1. Form a group of 4 or 5 students and discuss the topic 'Qualities of an effective leader'. Each group will prepare its list with justification to the entire class and write an assignment under the guidance of subject teacher.
2. Form a pair of student and each one from pair will ask each other questionnaire on motivation, self-motivation, experiences that motivated him or other which him for success in the past and write an assignment under the guidance of subject teacher based on discussion.
3. Form a group of 4 or 5 students and assign them a group activity such as 'making a shape from match stick (50 to 100 match sticks) without guidance and without group discussion.
4. The group as in activity 3 will now perform the same activity. After group discussion and under guidance of subject teacher, each student from a group will write an assignment for both the activities and write their inferences with reference to group discussion, team development, team building, etc.
5. Form a group of 8 to 10 student and arrange a group activity such as;
  - Industrial visit.
  - Visit to any historical place/fort/museum etc.
  - Housekeeping and cleaning of any laboratory/seminar hall for any function.
 After the execution of activity student will write an assignment under guidance of teacher keeping in mind individual role, purpose of activity, inter dependency of work or task, coordination of person and task involved and final performance.
6. Write an assignment on interpersonal relationship and conflict management with student's personal experience of solving conflicts.
7. Form a group of 20 students and ask them to prepare a list of 8 to 10 problems affecting the institute. Subject teacher should analyze one such problem on black board using 'Fish bone technique' with the participation of students. Students will write an assignment consisting;
  - Apparent problem statement.
  - Analysis of the causes.
  - Definition of real problem.



8. The subject teacher starts the session with 'Statement of the problem' written on the black board. After ensuring that all the participants are at the same level of understanding the statement of problem, he initiates NGT (Normal Group Technique) to arrive at maximum possible number of creative solutions.

Based on ranking matrix the group will arrive at feasible solutions and students will write an assignment consisting of;

- Problem Statement.
  - Model of problem solving.
  - List of creative solution suggested by participants.
  - Write the most feasible solution based on given criteria.
9. Form a group of 4 to 5 students and give them a topic for GD for 10 to 15 minutes. Teacher should analyse GD on certain parameters and students will write an assignment on aspects of GD and prepare a format (suggested or designed by teacher) which gives details of GD carried out.
10. Arrange a guest lecture of H.R. Person from industry/expert in interview technique and conduct mock interview of each student. Student should write a report on this activity.
11. Arrange a visit to industry and gather information about organisation, product, turnover, work culture, vision/mission statement, quality policy, Corporate social responsibility etc. and write a report on it.

**Note - Subject teacher shall guide the students in completing the assignments based on above practicals.**

#### Learning Resources:

##### Books:

Sr. No.	Author	Name of Book	Publication
1	Subject Experts-MSBTE	Handbook and assignment book on Development of Life Skills-II	MSBTE
2	Dr. Kumkum Mukherjee	Principles of management and organizational behaviour	Tata McGraw Hill Education Pvt Ltd.
3	Dr.T.Kalyana Chakravarti Dr.T.Latha Chakravarti	Soft Skills for Managers	Biztantra
4	Barun K Mitra	Personality Development and soft skills	Oxford University Press
5	Priyadarshini Patnaik	Group discussion and interview skills	Foundation Books

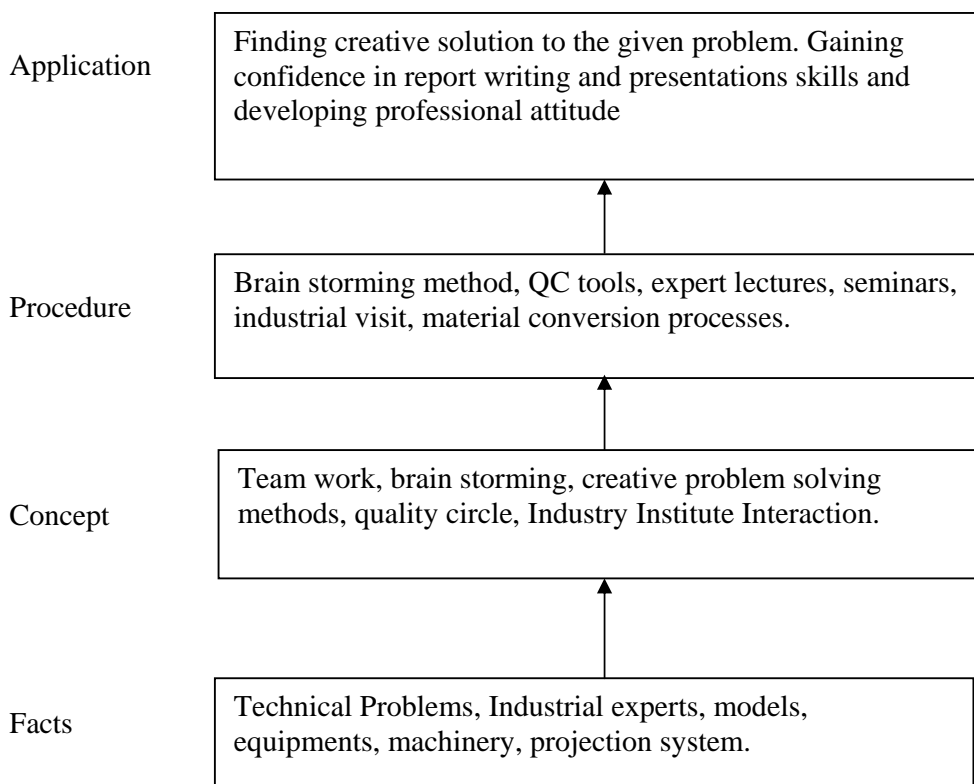
**Course Name : Diploma in Plastics Engineering****Course Code : PS****Semester : Fifth****Subject Title : Professional Practices-III****Subject Code : 17072****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	03	--	--	--	--	50@	50

**Rationale:**

Overall professional development of diploma mechanical engineers is the need of the day for enabling them to sustain in competitive global environment.

Professional development of Diploma engineering students is to be done by exposing them to various simulative situations in the industries. This can be achieved by inculcating attitude to face the problems, get alternative solutions and validation of the selected alternatives. This is achieved by involving students in activities such as inviting experts from various industries for sharing their experiences, arranging industrial visits, quality circles, seminars and mini projects activities etc.

**Learning Structure:**

**Contents:**

Activity	Practical Hours
<p><b>Topic 1. Idea Generation for final semester Project selection:-</b>  The student should use innovation principles for Idea generation. These ideas should lead to selection of Project. Head of Department should allot the project guides for the activity and form groups of four students per project.  Following are of the guidelines for projects selection.</p> <ul style="list-style-type: none"> <li>• Development of working models.</li> <li>• Development of attachments to machine tools.</li> <li>• Reconditioning of existing equipments, machines in the Institute.</li> <li>• Industrial Problem Solving.</li> <li>• Interdisciplinary Projects.</li> <li>• Use of Non conventional Energy sources.</li> <li>• Use of appropriate technology.</li> <li>• Agro based projects to reduce drudgery of farmers.</li> <li>• Ergonomic equipments</li> <li>• Jig, fixtures, dies, special purpose tools</li> <li>• Any project on Low Cost Automation</li> <li>• Automation Problems in industries</li> <li>• Experimental setups required in laboratories for measurement of parameters and component performance.</li> <li>• Any other project suitable for Industry and Institute.</li> </ul> <p><b>Note:-</b>The project group should submit their progress report, activity planning, any preliminary calculations to evaluate the project to be submitted at the end of the semester .  The student should submit a report for the project which will have proportional weightage in the term work</p>	06
<p><b>Topic 2. Industrial Visits</b>  Structured industrial visits be arranged and report of the same shall be submitted by the individual student, to form a part of the term work.  Following are the <b>suggested</b> types of Industries/ Fields. The subject teacher(s) have liberty to select nearby organization/industry</p> <ul style="list-style-type: none"> <li>• Industrial visit to pipe manufacturing Plant &amp; understand Processing line, die &amp; auxiliary machine</li> <li>• Industrial visit to film manufacturing Plant &amp; understand Processing line, die &amp; auxiliary machine</li> <li>• Industrial visit to injection molding plant &amp; understand the injection mold, ejection system &amp; process parameter.</li> <li>• Industrial visit to blow molding industries Understand process &amp; effect of process parameter.</li> </ul> <p><b>Note:- One Industrial visits be arranged per practical batch of students.</b></p>	06

<p><b>Topic 3. The Professionals/ Industrial Expert Lecture/s</b>  Experts/Professionals from different field/industries be invited to deliver lectures of 2 Hrs. duration at least TWO occasion. The topics may be selected by the teacher / industry expert to develop required skills .The following topics may serve guidelines.</p> <ul style="list-style-type: none"> <li>• Hot runner mold &amp; its used in injection molding machine</li> <li>• High tonnage injection molding machine</li> <li>• Bio-degradable plastic Opportunities in software industries.</li> <li>• Quality control method in plastic industries</li> <li>• Advanced additives in Plastic compounding</li> </ul> <p>Note: The brief report to be submitted on these lectures by each student as a part of Term work</p>	06
<p><b>Topic 4. Students Quality Circles:</b>  The students should form Quality Circles consisting of group of six to eight students and brain storm on various problems faced by students, use QC tools to find root causes and alternative solutions.  Following are some of the problems undertaken by students Quality Circle -  Poor vocabulary of Diploma Engineering students  Poor practical skills of Diploma Engineering students  Poor Journal preparation of Diploma Engineering students  Poor Entrepreneurial abilities of Diploma Engineering students  Students and teacher can select different problems according to their priorities. The students should prepare QC register and Case Study presentation. Present this case study in the class.   Such Quality Circles can participate in State level and National Level Conventions organized by Quality Circle Forum of India. For additional information visit website <a href="http://www.qcfihq.com">www.qcfihq.com</a></p>	12
<p><b>Topic 5. Seminar :</b>  Seminar topic may be related to the subjects of fifth semester / topics from guest lectures. Students shall submit a report of at least 5 typed pages (font size 12 all Margins 1" A4 size) (Presentation time – 10 minutes per student)</p>	06
<p><b>Topic 6. Mini Projects: (in a group of 4-5 students)</b> Students can choose any mini project of their interest. Mini Projects means a short term project which may be completed in 2 to 3 months and with a limited scope. Suggestive topics for guidance are as follows :  Process parameter &amp; its effect on quality of injection molding, blow molding, extrusion &amp; thermoforming.  Prepared chart of extrusion machine manufacturing India &amp; abroad  Prepared chart of Injection molding machine manufacturer in India &amp; abroad  Prepared chart of Thermoforming machine manufacturer in India &amp; abroad  Students shall arrange exhibition of all mini projects in the class/hall and present the task to the audience/ experts/examiners. The student shall submit a brief report (Max. 5 pages) of the mini project.</p>	12
<b>Total</b>	<b>48</b>

**Learning Resources:****1. Books:**

Sr. No.	Author	Title	Publisher
01	NRDC, Publication Bi Monthly Journal	Invention Intelligence Journal	National Research Development Corportion, GOI.
02	DK Publishing	How things works encyclopedia	DK Publishing
03	QCFI Publication, Secunderabad	Quality Circle Concepts and Implementation, 5S, KAIZEN 6 SIGMA TRIZ TQM SPC TPM SMED ERP	QCFI Publication, Secunderabad Visit website <a href="http://www.qcfihq.com">www.qcfihq.com</a> for details
04	Paul Trott	Innovation Management and New Product Development 4 <sup>th</sup> Ed.(2008)	Pearson Education
05	Joe Tidd	Managing Innovation,3rd Ed.	Wiley India

**2.CD-ROM:**

Federation of Indian Chambers of Commerce and Industries (FICCI) has developed 7 internationally acclaimed CD-ROM titles on various aspects of Quality Management & Business Excellence, which enable the organizations in achieving their ‘mission critical objectives’ in a cost-effective manner.

1. Developing continuous improvement as an organizational strategy
2. Strategies for becoming a customer driven organization
3. Six Sigma - A breakthrough strategy
4. Seven steps to World Class Manufacturing.
5. Maximizing business results and competitive advantages
6. Concise Encyclopedia of Business Excellence
7. Developing a passion to excel

For more details log on to: [www.ficci.com/fqf03/index.htm](http://www.ficci.com/fqf03/index.htm)

**3. Web sites**

[www.start2think.com](http://www.start2think.com)  
[www.Innovationgoldmine.com](http://www.Innovationgoldmine.com)  
[www.engineeringforchange.org](http://www.engineeringforchange.org)  
[www.qcfihq.com](http://www.qcfihq.com)  
[www.wikipedia.com](http://www.wikipedia.com)  
[www.slideshare.com](http://www.slideshare.com)  
[www.teachertube.com](http://www.teachertube.com)

**Industrial Training (Optional)**

- Students who have completed industrial training in summer vacation after 4<sup>th</sup> Semester will be granted exemption for activities related to topic 1 to 4.
- These students shall submit report of Industrial training signed and certified by authorities from Industry. Student will give seminar on industry training attended by him.
- Evaluation will be done on seminar and report submitted by student.