

9/1

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALA

(UNIVERSITY OF TECHNOLOGY OF MADHYA PRADESH)



SECTION :

SUBJECT :

V/4, OFFICE COMPLEX, GAUTAM NAGAR, BHOPAL-462 023  
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**SCHEME OF STUDIES AND EXAM. OF DIPLOMA IN PLASTIC TECHNOLOGY**

M.P.E.T. - 05

S. NO.	CODE NO.	COURSE SUBJECT	PRE. HOUR/WEEK		CREDIT	DESSIGNAL TERM LAB	PROGRESSIVE ASSESSMENT	BOARD EXAM PAPER	THEORY MARKS	PRACTIZING PAPER MARKS
			TH	PR.						
HARD CORE										
1.	1CH/PCR/PT/APP-MECH-201	CH/PCR/PT-APP-MECH	3	2	4	20	10	10	100	100
2.	1CHE/CH/PT/ENGS-DRAWING-202	CHE/CH/PT-ENGS-DRAWING	2	4	4	20	10	10	100	100
3.	1CTM/CH/PT/WORK SHOP-203	CTM/CH/PT-WORK SHOP	3	3	4	20	10	10	100	100
4.	1PT/204	ORGANIC POLYMER CHEMISTRY	2	2	4	15	10	10	100	100
TOTAL						155	50	50	300	300

REMARKS: ALL SUBJECT ARE COMPULSARY TO ALL STUDENTS

TOTAL OF I + II TERM UNDER EACH CATEGORY

(S. No. 1) (M. Schurt)  
 (S. No. 2) (M. Schurt)  
 (S. No. 3) (M. Schurt)  
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9/4

MADHYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL

SCHEME OF STUDIES AND EXAM OF DIPLOMA IN PLASTIC TECHNOLOGY

M.P.E.T.C.S.

S. NO	CODE NO	COURSE SUBJECT	PRE REQ SITE	HOURS	CREDIT	SESSIONAL TERM LAB	PROGRESSIVE ASSESSMENT	BOARD PAPER	EXAM HRS	THEORY MARKS	PRACTICE/VIVA	REMARKS
		SOFT-CORE										
1.	1A301	GEN/CH/ETI - COMP APP.		2	2	20	10	1	3HRS	100	1	50
		PT/POR										
2.	1A302	GEN/CH/ETI - ENVIRONMENTAL ENGG.		2	2	20	10	1	3HRS	100	1	50
		PT/POR										
3.	1A303	GEN/CH/PT - MARKING		2	2	20	10	1	3HRS	100	1	50
		PCR/ET										
4.	1A304	GEN/CH/PT - N.C.S.F.		2	2	20	10	1	3HRS	100	1	50
		PCR/ET										
5.	1A305	GEN/PT - EXT PRODUCTION		2	2	20	10	1	3HRS	100	1	50
		PCR/ET										
6.	1A307	GEN/CH/PT - MATHS-III		2	2	20	10	1	3HRS	100	1	50
		PCR/ET										
				TOTAL		60	60	30	30	300		150

REMARKS: ANY THREE COURSES WILL BE OFFERED BY EACH STUDENT (TOTAL CREDIT 9)

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MHARAYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL

SCHEME OF STUDIES AND EXAM. OF DIPLOMA IN PLASTIC TECHNOLOGY

M.P.F.A.C.S.

S. NO	CODE NO	COURSE SUBJECT	PRE. HOUR/WEEK			CREDIT	REGIONAL	PROGRESSIVE	BOARD	EXAM	THEORY	PRACTICE	TOTAL
			TH	PR	PR								
BASIC TECHNOLOGY													
1966	PT/401	POLYMER CHEMISTRY/PT/401	3	2	4	20	10	10	1	2HRS	100	1	3 50
1963	PT/402	PLASTIC PROS-1/PT/402	3	2	4	20	10	10	1	2HRS	100	1	3 50
1965	PT/403	PLS TECHNOLOGY/PT/403	3	2	4	20	10	10	1	2HRS	100	1	3 50
1967	PT/404	PLASTIC MATERIALS/PT/404	3	2	4	20	10	10	1	2HRS	100	1	3 50
1961	PT/406	DESIGN & DRAWING/PT/406	3	2	4	20	10	10	1	2HRS	100	1	3 50
1964	PT/407	MECH. TECHNOLOGY/PT/407	3	2	4	20	10	10	1	2HRS	100	1	3 50
1968	PT/408	IMPLANT TRAINING/PT/408	3	2	4	20	10	10	1	2HRS	100	1	3 50
1968	PT/409	EDUCATIONAL TOUR/PT/409	4	2	5	20	20	10	1	2HRS	100	1	3 50
TOTAL						200	160	80	80	800	450		

REMARK: ALL COURSE ARE COMPLESARY

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL

M.P.E. & C.S.

SCHEME OF STUDIES AND EXAM. OF DIPLOMA IN PLASTIC TECHNOLOGY

S. NO.	COURSE NO.	COURSE SUBJECT	PRE REQ. FIGURE	PRE HOUR/WEEK	TH	PR	CREDIT	SESSIONAL TERM/LAB	PROGRESSIVE ASSESSMENT	BOARD PAPER	EXAM. HRS	THEORY MARKS	PRACTI. HRS	VIVA	
		APPLIED TECHNOLOGY													
1.	PT/501	PLASTIC PROBS-I	402	4	4	4	6	20	10-10	1	3HRS	100	1	3-50	
2.	PT/502	PLASTIC PROBS-II	402	4	4	4	6	20	10-10	1	3HRS	100	1	3-50	
3.	PT/503	MOULD DESIGN & FABRICATION-I	403	4	4	4	6	20	10-10	1	3HRS	100	1	3-50	
4.	PT/504	MOULD DESIGN & FABRICATION-II	403	4	4	4	6	20	10-10	1	3HRS	100	1	3-50	
5.	PT/505	PROJECT DESIGN		4	2	2	5	20	10-10	1	3HRS	100	1	3-50	
6.	PT/506	PROPERTIES TESTING AND QUALITY CONTROL		5	2	2	6	20	10-10	1	3HRS	100	1	3-50	
7.	PT/507	PRODUCTION MGMT.		4	2	2	4	20	10-10	1	3HRS	100	1	3-50	
8.	PT/508	PROJECT INCLUDING FEEDBACK	90	6	1	1	6	30							
								140	70	70	700			350	
TOTAL															

REMARKS: 1. ALL COURSES ARE COMPULSORY. 2. THE STUDENT WILL NOT BE ALLOWED TO TAKE UP 5 TH & 6 TH LEVEL COURSES UNLESS HE CLEARS ALL THE FOUNDATION COURSES.

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MADHYA PRADESH BOARD OF TECHNICAL EDUCATION BHOPAL  
 SCHEME OF STUDIES AND EXAM OF DIPLOMA IN PLASTIC TECHNOLOGY M.P.E.S.C.B.

IS. NO.	CODE NO	COURSE SUBJECT	PRE HOUR/ WEEK		CREDIT	SESSIONAL TERM LAB	PROGRESSIVE BOARD PAPER	EYAP HRS	THEORY MARKS	PRACTICAL MARKS	TOTAL
			TH	PR							
1	PT/601	DIVERSIFIED COURSE PROCESS INST.	3	2	4	20	10	10	100	100	200
2	PT/602	POLYMER BLENDS LACTOGEN COMPONDS	3	2	4	20	10	10	100	100	200
3	PT/603	PLASTICS BASIC MELTING POINT	3	2	4	20	10	10	100	100	200
4	PT/604	CONDENSATIONS RING TECHNIQUE	3	2	4	20	10	10	100	100	200
5	PT/605	PLANT MAINTENANCE	3	2	4	20	10	10	100	100	200

REMARK: ANY TWO COURSES WILL BE OFFERED BY EACH STUDENTS

TOTAL 40 40 20 20 200 200 100

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 P. S. SINGH  
 G. S. SINGH  
 G. S. SINGH  
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Unit 1 - Fundamental concept of organic chemistry classification & nomenclature of organic <sup>comp.</sup> mechanism of chemical bond, Tetravalency of carbon atom, Detection of C, H, O, N & Halogens in organic compounds.

Unit 2 - Fundamental concept of polymer science, concept of macromolecule, polymer & oligomer, elementary idea about the bonds in macromolecule intermolecular & intramolecular forces.

Unit 3 - Types of Polymerisation: condensation & Addition Polymerisation.  
Condensation polymerisation - concept of functionality, industrial applications of condensation polymerisation.  
Addition polymerisation - elementary idea about initiation, propagation & termination reaction.  
Industrial applications of addition polymerisation.  
Degree of Polymerisation.

Unit 4 - Raw material, preparation, properties and use for polymers and resins such as phenol, cresol, resorcinol, biophenols, aldehydes like formaldehyde, furfuraldehyde, amino compounds like urea, melamine, aniline, paratoluene etc., poly functional acids & alcohols like phthalic anhydride, Terephthalic acid, adipic acid, sebacic acid, malic acid, fumaric acid, Glycols, Glycine or glycerine, pentaerythritol, Hexa methylene diamines and polyamines, ethylene, Acetylene, butadiene, Propylene, Styrene, acrylic-esters and acrylonitrile, epichlorohydrin, vinyl chloride.



9/9

Unit 5 - Testing of raw material and plastics such  
density, acid value, saponification value, hydroxyl value  
viscosity, refractive index, flash point, fire  
point, pour point, softening temperature  
melting temperature and significance of the test

Lab/ Team Work -

- (1) Measurement of specific gravity
- (2) Preparation of phenol formaldehyde
- (3) Preparation of thermoset moulding compound
- (4) Measurement of softening point and melting point
- (5) Molecular weight determination
- (6) Percentage of moisture content

Unit-I : Classification of Plastics such as Thermoplastics and thermosetting commodity engineering & high performance plastics. Classification of Polymers on the basis of applications such as Plastics, elastomers, fibres & adhesives & Their Examples.

Unit-II : Brief idea about:

Techniques of Polymerisation such as Bulk Polymerisation, Solution Polymerisation, Emulsion Polymerisation, Suspension Polymerisation.

Merits and demerits of these techniques. Some industrial applications for these Techniques.

Unit-III : Copolymerisation - Types Block and graft copolymerisation. Basic idea about mechanism and applications of Copolymerisation.

Unit-IV : Manufacturing processes for Plastics such as (only brief description & flow sheets)

- Polyethylene, Polypropylene, Polystyrene, PVC, Nylon, Bakelite, Polyester.

Unit-V : Structure of Polymers such as linear, Branched and cross linked Polymers. Crystalline and amorphous Polymers, physical properties of Polymers. Such as bulk density, av. mole wt, molecular wt. distribution and  $\lambda$  value. Factors affecting mechanical, thermal and electrical properties of plastics.

9/11

10

Lab / Term work

1. Identification of monomers.
2. Cementing and adhesives.
3. Determination of filler.
4. Identification of polymers.
5. Preparation of typical condensation and addition polymers.
6. Wet and dry blending of plastic materials.

1965

II<sup>nd</sup> Year - 11 - 9/12  
III<sup>rd</sup> Sem. Sub. S. No. 4-1

Work Shop Technology

• Rationale

Work shop Technology deals with basic equipments used in almost all branches of engineering. In this course <sup>conveniently</sup> <sup>designed for equipments</sup> specially <sup>concerns</sup> with plastic engineering.

• CONTENTS

1. LATHE

- Introduction and working principle
- Classification
- Specification
- Various operations on lathe
- Lathe tool
- Tool materials, speeds and feed.

2. SHAPING AND PLANING

- Constructional details and working principle
- Specifications for various operations.

3. DRILLING AND TAPPING

- Drilling, principle and details of drilling w/c specifications & types of machines, tool geometry reaming and tapping.

4. MILLING

- Milling, Introduction and classification of milling machines. Constructional details, specification upmilling and down milling, indexing.

5. BORING MACHINES

- Boring principles and construction of boring machine, types of boring machine including its boring, types of operations.

-83- 9/13  
-12-

## 6. GRINDING

- Grinding, principle and type of grind machine, constituents of grinding wheel, types of grinding wheel, selection of grind wheel, dressing and true turning of grind wheel, tool and cutter grinder.

## 7. POLISHING

- Polishing tools, sequence of polishing operation, importance of polishing for mould impressions.

### • Lab Work

Atleast one job on following skills to be given making a total of ten.

1. Stop Turning
2. Taper Turning
3. Screw cutting
4. Boring on lathe
5. Shaper/planer operation
6. Milling machine operation
7. Surface grinding operation
8. Cyl. grinding
9. Polishing

9/14

84  
Year

15  
-18- IV<sup>th</sup> Sem. Sub. No. 4.2

Polymer - Chemistry 4.2  
PLASTIC - MATERIALS

• Rationale

In this course properties and application of plastic and their different compounds are included. Students will also learn to classify different additives and Engineering plastics.

• CONTENTS

1. - Functionality and its importance  
- Methods of polymerisation and polymerisation catalysts
2. Properties of plastics material like HDPE, HMDPE, LDPE, PP, PS, PVC etc.
  - Mechanical
  - Thermal
  - Optical
  - Chemical
  - Environmental
  - Permeability
3. Properties and application of thermoplastics material
  - Polyolefin, Polyamides, polystyrene and its copolymers polyvinylchlorides, PVA and acrylics, polycarbonates, polyacetal, polymethac, polyston, celluloses, Casein, Teflon, polypeptides.
4. Properties and applications of thermosetting plastics
  - Phenolics, amino polymers, Epoxy, silicones.
5. Compounding.
  - Compounding of PVC
  - methods of compounding
  - Formulations of PVC compounding and effects of ingredients for different applications
  - Thermoset compound preparation
  - Fillers and ingredients for compounds
  - method of preparation of thermoset compound
  - Applications.

6. Speciality Plastics

- Silicons, PPO, Polysulphones, EVA, FEA, EVAL, PVDC, PVDF, PEEK.

7. General Principles of Selection of various additives

- Plasticizers, stabilizers, colourants, antioxidants, blowing agents, anti static agents, slip and anti-block additives, lubricants, heat and light stabilizers

• Lab/Term Work

1. Identification test for different plastics
2. Measurement of Bulk factor of thermoset compound
3. Measurement of curing time for thermoset compound
4. Measurement of Impact strength
5. Measurement of tensile properties
6. Measurement of hardness
7. Measurement of surface and volume resistivity.
8. Measurement of melt flow index
9. Formulation of moulding powders by compounding with different ingredients.

## Contents

1. Injection moulding -  
Introduction, types of moulding machine, plasticizing and preplasticizing, mould cycle, pressure temp. diagram, process variables, machine parts and their functions, types of nozzles, types of screwdrives drive mechanisms, feeding and feed control, preheating of raw materials, start up and shut down procedure, purging and cleaning, shot capacity and plasticizing capacity, machine specification, moulding, process selection, criteria, trouble shooting, defects and remedies in injection molded articles.
2. Compression moulding -  
Introduction, types of compression moulding press, moulding materials and preheating, moulding cycle, process variables, moulding machine details, charging and performing, post curing, cooling, fixures and finishing, heating and heat control, moulding defects, causes and remedies.
3. Transfer moulding -  
Introduction, transfer moulding press and accessories and types of transfer moulding techniques, process variables, hot dimensions and its effects, transfer moulding press specifications, comparison between compression and transfer moulding, cause of defects & remedies for transfer moulded articles.
4. Injection moulding of thermosets -  
Introduction, moulding machine details, start up running & shut down procedure, process variables and limitations, advanced machine design & control.



Laboratory Experiences / Special Techniques - 1

1. Moulding setting and operation on hand injection moulding machine.
2. Moulding setting and operation on hand compression moulding machine.
3. Mould setting and operation on injection moulding machine.
4. Mould setting and operation on compression moulding machine.
5. Determination of cycle time for given compression moulding machine article.
6. Effect of preheating on curing time and on quality of end product.
7. Effect of process variables on injection moulding products.
8. Effect of process variables on compression moulding products.

List of Demonstration

1. To show main parts of an injection moulding machine.
2. To show elements of hydraulic circuit of an injection/compression moulding machine.
3. To show elements of electric circuit of an injection/compression moulding machine.
4. To show main parts and accessories of compression moulding machine.

9/18

2nd Year

-86-

-20-

IV<sup>th</sup> Sem. Sub. C. No. 4.3

17

## Elements of mould Design and Drawing

### CONTENTS

43

1. Elements of hand injection mould.  
Parting line, core, cavity, runner, gate, ejection, back-plates, dowels, socket-headed screws, method of assembly, drawing and detail drawing.
2. Elements of hand compression mould.  
Parting line, core and cavity, powder well, pressure pads, load, ejection, back plates, dowels and screws, method of assembly, drawing and detail drawing.
3. Elements of two plate mould.  
Parting line, core and cavity inserts/plates, sprue runners and gates, Locating ring, back-plates, ejector assembly, spacer-blocks, knock out rod, guide pin and guide bush, dowels and socket-headed screws, cooling channels.
4. Elements of compression mould:  
parting line, core and cavity inserts/plates, powder well load area, pressure pads, back plates, ejector-system, heating channels.
5. Feed System.  
sprue, runner cross section shape, size, lay-out, gates, types of gates, gate size, location of gates and balancing gates.
6. Ejection System.  
ejector assembly, ejector plate, ejector back plate, ejectors, push back pin, support-pin, stop pin, and knock outrod, ejector housing

7. Cooling System

Interger cavity, plate cooling, interger core plate cooling, insert cooling, cooling of shallow inserts, deep core cooling, cylindrical core cooling, cooling of other mould components, water connections.

8. Heating System.

Lab/ Term Work

1. Mould component drawings.
2. Details and assembly of hot injection mould
3. Details and assembly of hot compression mould
4. Details drawing from given assembly drawing.

Unit - I

- D.C. circuits & D.C. machines
- (A) Review of concepts of electrical engg. voltage, current, power, resistance, D.C. circuit, Kirchhoff's law & ohm's law.
  - (B) Constructional feature of D.C. m/c, Armature winding and e.m.f. equation.
  - (C) D.C. motors and their load characteristics, series, shunt, compound.
  - (D) Different types of starters, methods of speed control of D.C. motors.

Unit - II

- (A) A.C. circuits: Alternating current, wave forms, RMS, average value, form factor, power factor, R, L and C in A.C. circuit, 3 phase A.C. star and delta connections, different types of A.C. supply used in common industrial application i.e. 1 phase, 3-phase-3 wire and 3-phase-4 wire.
- (B) Transformers: principle of operation of e.m.f. equation, transformation ratio, constructional detail.

Unit - III

- 3 phase A.C. machines: constructional features of induction motors, cage type and slipping type: principles of operation of 3 phase induction motor, slip and slip frequency, application of induction motor. Working principle of single phase induction motor. Synchronous motor and alternator: constructional feature, principle and application.

Electrical measuring instruments: main feature, circuit connections and uses of Ammeter, Voltmeter, wattmeter and multimeter, working principles of H.I. and M.C. type instruments.

Unit-V

electronics: Semi conductor devices, Diode, Transistor, SCR, Rectifier circuit, H.W. and F.W. filters in power supply circuits, Amplifier action of transistor.

Experiments:

1. Study of D.C. m/c.
2. speed control of D.C. motors.
3. Study of D.C. motor starters.
4. Performance of RLC series and parallel circuits.
5. Star and delta connection - Verification of phase and line voltage and current.
6. Determination of efficiency Transformation ratio.
7. Determination of efficiency of a single phase transformer by C.C. and S.C. tests.
8. Study and operation of 3 phase squirrel cage and slip ring induction motors.
9. Study and operation of starters for induction motors.



- 21-  
9/22
10. Study and operation of single phase induction motors.
  11. Study and mode of connection of different types of measuring instruments.
  12. Measurement of power and energy in a single phase circuit.
  13. Measurement of power and energy in a 3-phase circuit by 2 wattmeter method.
  14. Study of various electronic devices such as diodes, transistors, FET, SCR etc.
  15. Study of rectifiers and observation of wave form on CRO.
  16. Study of battery charging circuits.
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MECHANICAL TECHNOLOGY  
(including materials)

• Contents

- I. Introduction of engineering materials and their properties, classification of metals and non-metals engineering application of materials, properties required for engineering material.
- II. Metallurgical considerations of metals, structure of metals, process of crystallisation of metals, dendritic solidification, types of space lattices, grain and grain boundaries, allotropy of metals, types of crystals and its effect on mechanical properties, alloys and their importance, equilibrium diagram, Iron-carbon equilibrium diagram.
- III. Ferrous metals and alloys, types of steels, composition and uses of cast iron, effects of silicon sulphur and phosphorus, effect of alloying elements on steels such as chromium, nickel, manganese, tungsten, vanadium etc., composition of alloy steels.
- IV. Non-ferrous metals and alloys, properties and uses of aluminium and its alloys, copper and its alloys, brass-bronze metal, metal metal bearing metal.

V Heat treatment of steels, principle of heat treatment, description of processes of annealing and process annealing, tempering, case-hardening.

VI Selection and specification of materials, methods of specification of metal, selection of metals.

VII Foundry, pattern-making, casting technique defects in casting.

VIII Fitting :- fitting tools, limit fits and tolerances measuring instruments and gauges used in fitting.

#### o Lab/Term Work

1. Study of metallurgical microscope
2. Specimen preparation for microscope
3. Micro structure for steel and C.I.
4. Heat treatment of steels
5. Pattern making for plastics processing.
6. Fitting exercises for plastics moulds.



9/25

Unit operation

1968

27

1. Types of fluid, Newtonian and Non-Newtonian fluids, Hydrostatic equilibrium, Equilibrium in centrifugal field.
2. Fluid dynamics: Flow of Newtonian fluids through circular conduits, Bernoulli's theorem. Friction losses in pipes and fittings, skin and form friction.
3. Fluid flowmeters - Orifice and venturimeters, pitot tube and rotameters, flow measurement through notches and weirs.
4. Principle and operation of hydraulic pumps, motors and valves. Types of pumps, motors and valves and their performance. Hydraulic circuits.
5. Air compressors - Working principle of air compressor, flow control valves.
6. Conductive heat transfer - steady state conduction, in one dimensional system with compound resistances in series, Heat transfer through pipes.
7. Convective heat transfer - surface and overall heat transfer coefficients. Varying temperature drop for counter current and co-current flows. Dittus-Boelter equation and its application.
8. Heat exchanger equipments - Double pipe and shell and tube heat exchangers, basic design concept and calculations for double pipe, 1-1 and 1-2 heat exchangers, Drop wise and film wise condensation.
9. Drying and humidification operations - Mechanism of drying solids, Factors of influencing drying rate, Drying equipments, wet bulb theory, Adiabatic cooling, Cooling towers.
10. Mixing - General principle and equipments.

List of experiments -

1. Verification of Bernoulli's theorem.
2. Closed channel flow measurement.
3. open channel flow measurement.

4. Friction losses in pipes.
5. Study of flow profiles.
6. Thermal conductivity of solids.
7. Conduction heat transfer through compound resistance
8. Transfer coefficient for double/shell and tube exchanger.
9. Drying characteristics of solids.
10. Degree of Mixing for binary systems.

9/27

Plastic processing II

## 1. Extrusion process -

Introduction, types of extruders, constructional details of screw extruder, single screw, twin screw & planetary extruder and applications, extruder accessories, Auxiliary equipments, sizing Calibrators, startup running and shutdown procedure, extruder output, power requirement to drive screw extruder, extrusion out-put, Application, plant lay-out for different products, Trouble shooting, post-extrusion processes, extruder machine specifications, Application of extrusion for tubes, pipes, film, B.O.P.P., cast-film, sheets.

## 2. Chilling plant -

Significance of chilling, chilling plant details, chilling plant operations.

## 3. mixers and grinders for compounding of PVC equipments, construction &amp; working.

## 4. Requirement of surface treatment - - -

Requirement of surface treatment, methods of surface treatment, equipment of surface treatment, Assessment of surface treatment.

## 5. Blow moulding -

Introduction, Types of blow moulding processes, constructional details of blow moulding machines, parison blowing system, Accumulator system, parison thickness control system, Basic process, material and application, moulding defects, Causes remedies blow moulding etc, specification, start-up running shut down procedure, special blow moulding system, single <sup>or multiple station blow moulding</sup> softy devices, process parameters & there effect on product quality, Trouble shooting, defects caused & remedies.

- 92 -

27

(25) List of Laboratory Experiments

- (1) To run the extruder,
- (2) To set film die, run the extruder and to find out the out-put rate.
- (3) To run the extruder and to produce granule from scrap plastic material.
- (4) To set the blow mould, run the blow moulding machine and to find out the cycle time.
- (5) To run the automatic cutting and sealing machine and to prepare plastic bags of given size from given film roll.

List of Demonstration :-

- (1) To show extruder film plant and its details
- (2) To show construction details of extruder pipe machine.

9/28

# PROCESS INSTRUMENTATION 28

## Instrumentation Fundamentals.

1. Introduction
2. Selection of measuring instruments
3. Errors in instruments
4. Block diagrams of instrumentation system.

## TRANSDUCERS

1. Function and classification
2. Requirements of transducers
3. Types of transducers.

## DATA HANDLING

1. Introduction
2. Measuring Methods
3. Indicating means & recorders.

## PROCESS INSTRUMENTATION

EXPANSION THERMOMETER → Principle, Types of expansion thermometer, Mercury in glass thermometer, Bimetallic thermometers, Pressure spring thermometers and pneumatic pressure thermometer.

THERMOCOUPLES → Thermo electricity, Seebeck effect, Peltier effects, and Thomson effect, laws of Thermoelectric circuits, working principle and application of industrial thermocouples, Thermocouple lead wires, thermal well, Thermocouple circuits, millivoltmeter circuits and null-potentiometer circuit.

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9/29

RESISTANCE THERMOMETERS → Working Principle  
Construction and application, circuits,  
Wheatstone bridge, Callender Griffiths bridge.

PRESSURE & VACUUM MEASUREMENTS → Manometers,  
measuring elements for gauge pressure  
& differential pressure and vacuum. Bellows, Bourdon  
tube diaphragms, measurements of Absolute pressure  
- simple bellows and double bellows,  
Thermocouples, Pirani gauge, McLeod gauge,  
ionisation, indicating element for pressure gauge.

SERVO MECHANISM & CONTROL →

1. open loop and close loop control system
2. Block diagram representation.
3. Regulators & Servomechanisms.
4. Synthesis of control
5. Servomotors
6. Plant maintenance practice.

Experiments -

1. To measure the emf induced vs temperature for a given thermocouple.
2. To calibrate a given comparative type pressure transducer.
3. To calibrate a given inductive pick up.
4. Error calibration of Temperature measuring devices.
5. Study of pressure & vacuum gauges.
6. To study position control system using potentiometers.
7. To study construction and working of a given potentiometer strip-chart recorder.

9/30

## Plant Maintenance

30

1. Introduction to plant maintenance, Fault finding methods, preventive maintenance, maintenance practices
2. Wear, Corrosion and recovery methods
3. Planning and scheduling of maintenance work. Importance and approaches to planning, importance and approaches to scheduling, maintenance cost and economy, service life of equipment.
4. Lubrication - principle of lubrication, Types of lubricants and specifications, lubricating systems.
5. Installation and testing of Industrial equipments, Concrete foundation, vibration, Erection, Anti vibration mounts, testing and alignment methods.
6. Maintenance of plastic processing machines, Maintenance of extruder, maintenance of injection moulding machines, maintenance of blow moulding machines.
7. Safety - Introduction, management responsibilities and economic aspects, safety organisation and planning, maintaining interest in safety, Engineering factors in safety, accidents, Fire protection

### List of laboratory experiences -

1. Maintenance and repairs of hand injection/compression moulding machine component.
2. Maintenance and repairs of elements hydraulic system of injection/compression moulding machine.
3. Maintenance and repair of electrical system of injection/extruder/blow moulding machine.

9/31

31

4. Installation and testing of injection moulding machine / co-  
-molder.
5. Maintenance and repairs of screw and barrel of injection/  
blow / extruder machine
6. Maintenance and repair of take off unit of film / pipe  
plant.
7. Routine maintenance of injection / blow / extruder machine.

1971

9/32

Plastic Processing - III

Final Year

4th Sem. Sub. No. 5. 2

32

### 1. Thermoforming :-

Introduction, Basic thermoforming processes, materials and application, Advantage and limitations, Construction of thermoforming machines and moulds, methods of thermoforming, Process variables of thermoforming process, Trouble shooting, modern trends in thermoforming process.

### 2. Foaming Process :-

Introduction, Basic process and material & application. Structural foam moulding, Expandable styrene foam, polymethane foam.

### 3. Calendering :-

Introduction, Basic process, material, premixing blending and gelation, application, calendar roll arrangements, roll construction and heating, calendar roll driving and lubricating system, calendar plant lay-out, gauge thickness control for calendar sheets, Trouble shooting, post calendar processes.

### 4. Reinforced Plastics :-

Introduction, Raw material for R.P., Equipment for general use, R.P. moulding materials, material preparation techniques, moulding process, Defects, Causes and remedies application and advantages.

### 5. Miscellaneous Processes :-

Rotational process moulding, Coating Dip coating, Enea pultrusion, Powder coating, Laminating, slab moulding,

### 6. Fabrication :-

finishing, filing, grinding, buffing, drilling, turning, slitting, factoring etc., cementing and adhesive bonding, welding process, types and techniques, Fabrication techniques for tanks, pipes, bends, sheets etc.



9/33

33

List of Laboratory Experiences

- (1) To design and draw details and assembly drawings of Compression transfer mould. For manufacture of different components (at least five sheets)
- (2) Turning jobs involving step turning, taper turning
- (3) Shaping jobs, Planing & slot making
4. Milling Job, plain milling, end milling
5. Preparation of jobs involving drilling & boring
6. Preparation of jobs involving surface grinding

## Mould Design And Fabrication - I

## 1. Compression Moulds :-

Design of positive, semi positive and flash moulds  
 Hand moulds & automatic moulds, single mould, multi  
 impression moulds, three plate moulds, flash allowance,  
 shrinkage allowance and draft allowance, standard  
 components of compression moulds, typical design  
 cores & inserts, calculations for depth of cavity  
 and number of cavities required, Ejector  
 system - location and selection, Moulds for articles  
 with undercuts, split moulds, moulds with side  
 cores, external & internal threads, Land area  
 consideration, pressure pads, powder wall  
 calculation, Heating Load calculations, press  
 tonnage calculation.

## 2. Transfer Mould :-

Design of integral pot and auxiliary ram  
 type moulds, Typical designs of transfer pot,  
 transfer ram, sprue brush, runners & gate,  
 plunger transfer mould, transfer chamber  
 calculation, Cull removing technique, Gating  
 system, balanced runner system, Heating  
 elements, mould heating Steam heating, Thermic  
 fluid heating, Electrical heating

## 3. Mould Materials :-

Properties of mould materials, mould material  
 Heat treatment requirements, metal specification

## 4. Mould Fabrication Techniques

Casting, Lathe, shaping & planing, milling  
 Drilling & Boring, Broaching & sawing, grinding,  
 Pentagraph type die sinking machines, mould  
 polishing.

## List of Laboratory Experiments :

35

1. To design and draw details & assembly drawing  
 of two plate injection mould and to fabricate it.
2. To design and draw assembly drawing of three  
 plate injection mould.
- To design and draw assembly drawing of com-

## Final Year Mould Design And Fabrication - II

### 1. Injection Mould :-

Types two plates and three plate moulds  
 Ejection system, cooling system, gating systems  
 Mould for extended mould nozzle, Design  
 of the sizes of sprue, runners and gates,  
 sprue lock and ejection of sprue, runners &  
 gates, Hand moulds and automatic moulds  
 moulds for articles with undercuts, split mould  
 type of actuation, moulds with side cores,  
 consideration in deciding upon the parting line  
 Hot runner moulds - design considerations,  
 Elementary ideas of injection moulds for  
 thermosets including sheet mould compound  
 and bulk mould compound, mould economy  
 determination of number of cavities and  
 cost estimate.

### 2. Extrusion Die Design :-

Control of flow properties and heater design  
 Design aspects of - pipe die, Torpedo, man  
 land length, angle of entry, sheet die - a  
 hanger and T-die control of thickness,  
 monofilament - Die-stretch ratio and ultimate  
 thread size, Blown film and cast film  
 Tap die, profile Die - Elementary treatment

### 3. Blow Moulds :-

Die design for parison control with PVC and  
 Design of simple blow moulds, pinch off  
 angle, mould cooling, Extrusion blow mould  
 design, Injection blow mould design

Fabrication

9/36

98

Laboratory Experiences :-

35

1. To design and draw details and assembly of extrusion film/pipe die
2. To design and draw assembly drawing of split mould.
3. To design and draw assembly drawing of blow mould.
4. demonstrate various types of extruder dies like film die/pipe die/section die.
5. demonstrate split mould, blow mould

Laboratory

A. To

9/37

~~407~~  
op<sup>25</sup>  
Production Management - ~~64~~

3

(Final Year) VIIth Sem. Sub. S.No. 6

1. Introduction.  
management and supervisor's role in management, functions of management, Management of man, material and machine.
2. Production management.  
Production system concept, various departments and their relationship in the organisation, place of supervisor and his responsibility, recruitment and training of persons, motivation and morals
3. Plant lay-out and material handling.  
purpose and importance of layout, effects of lay-out on production, types of lay-out, importance of material handling, nature of material handling, equipments used,
4. Production Planning and Control  
Types of production and their basic characteristics, definitions and terminology in forecasting, elements of planning functions, material management, quality standard, elements of control functions, machine capacity, batch quantity, Gantt chart, CPM and PERT technique.
5. Inventory Control.  
Importance, types of inventory control, concept of EOQ, methods of controlling stock levels,
6. Operating costs :-  
definition, cost of production, cost of sales, Labour cost, material cost-

9/38

Properties Final Year  
Testing & Quality Control

1 Importance of testing specifications and standards, sample preparation and conditioning of sample, manufacturing and quality control tests

2 Mechanical Tests :-

Tensile, Impact, Flexural, creep, stress relaxation, Hardness, Abrasion.

Thermal tests melting point, vicat softening point, Heat deflection temp.

Dielectric strength, Arc resistance, Insulation resistance, Volume and surface resistivity.

Light transmittance, Haze, Gloss, clarity, melt flow index, cup flow index, viscosity, K-value, molecular weight, chemical resistance, Toxicity.

Environmental tests, environmental stress and cracking, weather resistance.

3 Quality Control :-

Basic concept - total quality control (T.Q.C) visual inspection, Interpretation of test data of raw material, Testing of finished product, analysis of test data, to control the processing parameters, Assessment of properties of finished product related to service requirements, control of test-atmosphere.

Practicals - To perform following tests

Tensile strength, Compressive strength  
Flexural strength, Tear strength, Impact strength  
Hardness, Softening point, melt flow index  
Abrasion strength, Flammability test, specific  
gravity, Moisture content, Identification test  
Drop test, Permeability test.

9/40

Product Design

1976

- TOPICS :
- \* I Technical requirement
    - Preliminary design considerations.
  - \* II
    - Selection of materials (19930)
    - Short term and long term properties
  - III Product Design features
    - Surface finish
    - Texturing
    - Shape
    - Positioning of holes
    - Ribs
    - Fillets and rounds
    - Wall thickness
    - Method of joining and machining such as welding rivetting cementing and adhesion, cutting, stamping, drilling etc.
    - Assembly methods
    - Inside sharp corners
    - Draft angles
    - Weld lines
    - Gate side and location
    - Moulded in inserts
    - Internal plastics threads
    - Undercuts
    - Tolerance
    - Functional surfaces and lettering.

- \* IV
  - Cost economics (19930)
  - Selection of manufacturing methods

- \* V
  - Shrinkage considerations

- \* VI
  - Sample product design for various applications
  - Structural members
  - Gears
  - Bearing

HOME WORK :

Three exercises of product design for various applications such as

- Injection moulded
- Extruded
- Blow moulded



112 9/91 (W)

SIXTH SEMESTER DIPLOMA IN PLASTIC ENGG.

6.5 PROJECT (including Entrepreneurship)

Rationale

The necessity of the project work has been emphasised on group work. Proper group functioning is a prerequisite for maximising output from a problem - solving group in work environment. Proper organisation of project work should be able to simulate such a situation so that all students are able to effectively work in groups and thus gain confidence to effectively take up responsibilities in their careers. The student will prepare a final project report.

Topic - 'A'

SPECIMEN ON MINOR PROJECTS.

To prepare writeup or feasibility report containing not more than 1500 words, using appropriate diagrams & illustrations and in simple language to be understood by non-technical readers, about an engineering topic, such as :-

Suggested topics :-

- (\*) Feasibility P.V.C. shoe/chappal (through hand press) production in your locality.
  - (\*) Feasibility of Poly thene bags' production by blow moulding in your locality.
  - (\*) Feasibility of Production of reprocessed granules. (High density P.V.C.)
  - (\*) Feasibility of production of consumer products like Buckets, toys etc using proper grade of plastic.
2. Prepare a comparative study report about alternative materials available for a particular application.

Suggested Topics :-

- \* Shoes / chappals.
- \* Buckets.
- \* Electrical fittings.
- \* Furniture (moulded)
- \* Pipes for drainage system.

3. Prepare a technical paper to be read to the rest of the class, about the process of conversion of raw material into a finished product.

Suggested Topics :-

- \* Rigid PVC conduit for electrical concealed wiring.
- \* PVC granule from old shoes/chappals.
- \* PVC granule from old polythene bags.
- \* Plastic Bucket.
- \* Plastic Toys.

(Contd..2/-)

4. Prepare a survey report of the equipment available for a particular engineering product, make a comparative study and suggest suitable choice.

Suggested Topics :-

- \* PVC PIPE for IRRIGATION USE
- \* Any Engg. component (e.g. used in scooter/car/automobile)
- \* Cover of Fan regulator.
- \* Moulded furniture.
- \* Electrical switches / accessories.

TOPICS - 'B'

1. Prepare a simple machine or component as per given drawing specifications.

- \* Hand moulding press with heater.
- \* Mould for any simple plastic object.

2. Reclaiming x without screw of an extruder or any other component of an equipment and putting it to reuse

TOPICSx- 'C'

One project to be completed by a group of not more than 4 students.

- \* Design & Development of Mould for any object.
- \* To develop suitable hand operated press for producing.
- \* ~~For~~ electrical components x of bakelite / PVC.

Topic "D"

ENTREPRENEURSHIP

- 1.1 List the qualities of successful entrepreneurship.
- 1.2 Discuss the needs for self - employment training.
- 1.3 Discuss the area for self employments.
- 1.4 List and explain the information necessary for opening a small scale industry.
  - (a) Advx Advisory guidance and consultancy service.
  - (b) Preparation of project profiles and project report.
  - (c) Banking.
  - (d) Financial Assistance ( Agencies other than banks.).
  - (e) Training.
  - (f) Provision of raw materials.
  - (g) Provision of plot of land and other Infra - structures.
  - (h) Advice on Technical know - how machinery, tools , equipments and supply of same.
  - (i) Assistance in making facilities and marketing.
  - (j) Statutory requirements and industrial regulations.
  - (k) Financial management , return on investment, pay back period cost benefit analysis.
  - (l) Facilitations and aids being extended by.. B .. Govt. and financial Institutions.

OBJECTIVES FOR INPLANT TRAINING AFTER VTH SEMESTER

( Duration :- 4 Weeks )

The student will :-

1. Write details on the operations carried out in each unit
2. Gather information on
  - i. routine maintenance
  - ii. preventive maintenance
  - iii. Break down maintenance
3. Participate in maintenance work to gain knowledge in above three types of maintenance.

for each unit structured check list will be provided to each trainee on (i), (ii) & (iii).

To achieve the above objectives, activities will have to be planned in consultation with the officials of the concerned industry.

Students will be asked to maintain a daily diary during this inplant training period. It is to be ensured that the student gains varied experience in this period. He should get a chance to work on different types of machines like motors, injection moulding machines, Blow moulding machine, (hand operated, semi automatic or automatic) Extruders, screen printing machine, colour blending machine, Auto compression press, Vacuum forming machine, different types of mixers, grinders, sealing machines, different types of moulds etc. as the case may be.

The assessment of the inplant training will be made on the following three criterion.

1. Daily Diary
2. Report prepared by the student
3. Viva Voce

Marks will be awarded by internal & external examiners jointly

The student will be awarded diploma certificate only after successful completion of this training.

9/45

96

### 3. PETROLEUM REFINING - II

( L:2, P:3 )

#### RATIONALE :

Same as for 'Petroleum Refining - I'

#### CONTENT :

- I. Introduction to petroleum processing.
- II. Classification of refineries.
- III. Refining Operations :-
  - 1) Pretreatment of petroleum crudes.
    - ii) Petroleum refining :-
      - a) Distillation Method :

Dehydration, stabilization, primary distillation.  
Rerunning motor - fuel distillates, rerunning  
lubricating stocks, s-solvent recovery.
      - b) Chemical Methods :-

Sulfuric acid treatment - deasphaltization. Use  
of other refining agents like aluminium chloride,  
zinc chloride ; sweetening process- Removal of  
sulfur and nitrogen compounds.
      - c) Physical methods (adsorption)-

Fractionation, percolation, contact filtration  
methods, clay treatment of gasoline. Use of  
differential solvents and differential precipi-  
tation methods.

## III. Conversion processes :-

Typical cracking, visbreaking, reforming, alkylation and isomerization processes.

## IV. Dewaxing processes.

## V. Corrosion control in refinery and miscellaneous Chemical process equipments.

## List of experiments :-

Experiments on :-

- a) Pre-treatment
- b) Fractionation
- c) Acid - treatment
- d) Desulfurization
- e) Dewaxing of petroleum crude
- f) Thermal cracking
- g) Catalytic cracking
- h) Coking
- i) Vis-breaking
- j) Bitumen blowing (softening)

Text / Reference Books :

1. Petroleum Refinery Engg., Nelson.
2. Chemical Technology of petroleum, Gruce & Stevens.
3. Petroleum Processing, Hengstebeck, R. J.

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8. REFINERY MANAGEMENT & ENTREPRENEURSHIP DEVELOPMENT

( L:2, P: - )

RATIONALE :

A Diploma Engineer is supposed to work in a plant in a capacity which, as per the hierarchy falls in between the workers and the management, thus serving as an 'important link between the two aforesaid levels. He is, therefore, expected to know at least the fundamentals of management science. Some Diploma personnel might also venture, at some stage of their professional career (or otherwise) to go for their own manufacturing undertakings. Keeping this aspect in view topics relevant to entrepreneurship development have been included in the course content and the paper is accordingly titled.

CONTENT :

- I. Forms of business organization : Public sector, private sector and joint sector undertakings. Qualifications, functions and responsibilities of entrepreneur.
- II. Industrial Administration : Distinction between, Administration', 'Management' and Organization'. Managerial organization and organizational structure. pertinent to petrochemical plants and refineries. Production planning and control in oil refineries and petrochemical plants. Material management and personnel management. Industrial remuneration - Wages and incentives. Factory act, minimum wages act, trade union act, workmen's compensation act etc.

III. Cost control : Cost allocation and costing methods. Depreciation and amortization. Capital investment structure and cost control in oil refineries and petrochemical plants. Alternatives and replacement studies. Cost accounting, book-keeping, factory records and balance sheet.

IV. Locational factors pertinent to petroleum industry. Assessment of Indian oil economy in relation to that of other developing and developed countries of the world.

Text / Reference Books :

1. Industrial administration and Management, J. Batty.
2. Business Organisation & Management 13<sup>th</sup> edn., M.C. Shukla.
3. Economics for Chem. Engineering. Peter & Timmerhaus.

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9/99

110

9. PETROCHEMICAL TECHNOLOGY - II

( 1:2, P:2 )

RATIONALE :

Same as for 'Petrochemical Technology - I'

CONTENT :

- I. Technology of high polymers- Classification and properties of high polymers. Theory of polymerization. Reaction conditions for polymerization. Properties of resins, plastics and rubber. Role of additives in commercial/industrial plastic, rubber and resin formulations.
- II. Manufacture of neoprene, butadiene, polyethylene, propylene rubber, glycerine, isoprene, SER, ABS, caprolactam, phenol, nitrobenzene, carbon black, TNT, naphthols, PVC, aryl-alkyl sulfonates, BHC and parathion from petroleum feed stock.
- III. Scope of petrochemical industry in India - present status and future prospects.

List of experiments :

1. Estimation of :
  - a) Nitrobenzene,
  - b) Phenol and
  - c) B - naphthol.

2. Analysis of :
- Rubber latex
  - Natural and synthetic rubber.
  - Resins and plastics

Text / Reference Books :

- Chemicals from petroleum, Waddams.
- From hydrocarbons to petro-chemicals, Lewis F Hatch & Sami Matar.
- Chemical Technology, Vol-II, Shukla & Pande.
- Outlines of Chem. Tech., 2nd edn., C.E. Bryden.
- Principles of polymerization, G. Odian (MGH)
- Physical Chemistry of polymers, A. Tager. (Mir Pub.)
- Principles of polymer chemistry, P.R. Flory (Gorvele Press).

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9/51

### 8. REFINERY MANAGEMENT & ENTREPRENEURSHIP DEVELOPMENT

( L:2, P: - )

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9/52

III. Cost control : Cost allocation and costing methods. Depreciation and amortization. Capital investment structure and cost control in oil refineries and petrochemical plants. Alternatives and replacement studies. Cost accounting, book-keeping, factory records and balance sheet.

IV. Locational factors pertinent to petroleum industry. Assessment of Indian oil economy in relation to that of other developing and developed countries of the world.

Text / Reference Books :

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3. Economics for Chem. Engineering, Peter & Timerhaus.

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## 9. PETROCHEMICAL TECHNOLOGY - II

( I:2, P:2 )

## RATIONALE :

Same as for 'Petrochemical Technology - I'

## CONTENTS :

- I. Technology of high polymers- Classification and properties of high polymers. Theory of polymerization. Reaction conditions for polymerization. Properties of resins, plastics and rubber. Role of additives in commercial/industrial plastic, rubber and resin formulations.
- II. Manufacture of neoprene, butadiene, polyethylene, propylene rubber, glycerine, isoprene, SER, AES, caprolactam, phenol, nitrobenzene, carbon black, TNT, naphthols, PVC, aryl-alkyl sulfonates, BHC and parathion from petroleum feed stock.
- III. Scope of petrochemical industry in India - present status and future prospects.

List of experiments :

1. Estimation of :
  - a) Nitrobenzene,
  - b) Phenol and
  - c) B - naphthol.

9/54

2. Analysis of :
- a) Rubber latex
  - b) Natural and synthetic rubber.
  - c) Resins and plastics

Text / Reference Books :

1. Chemicals from petroleum, Waddams.
2. From hydrocarbons to petro-chemicals, Lewis F Hatch & Sami Matar.
3. Chemical Technology, Vol-II, Shukla & Panda.
4. Outlines of Chem. Tech., 2nd edn., C.E. Bryden.
5. Principles of polymerization, G. Odian (MCH)
6. Physical Chemistry of polymers, A. Tager. (Mir Pub.)
7. Principles of polymer chemistry, P.R. Flory (Corvete Press).

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## 9. PETROCHEMICAL TECHNOLOGY - II

( 1:2, P:2 )

## RATIONALE :

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- I. Technology of high polymers- Classification and properties of high polymers. Theory of polymerization. Reaction conditions for polymerization. Properties of resins, plastics and rubber. Role of additives in commercial/industrial plastic, rubber and resin formulations.
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