

Diploma in Plastics Technology (DPT)

SYLLABUS & CURRICULUM

REVISED: **AUGUST 2016**

Implemented from Academic Year: **2016-17**



Academic Cell
**Central Institute of Plastics Engineering &
Technology**

(Department of Chemicals & Petrochemicals,
Ministry of Chemicals & Fertilizers, Govt. of India)
Head Office, Guindy, Chennai – 600 032.

Tel. No.: 91-44-22254780
Email: hocipetolc@gmail.com

Fax: 91-44-22254787
Web: www.cipet.gov.in

DIPLOMA IN PLASTICS TECHNOLOGY SYLLABUS

SEMESTER - I

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
GE 101	Communication English-I	<u>48</u>	<u>06</u>	3	40	60	100
GE 102	Engineering Mathematics	<u>48</u>	<u>06</u>	3	40	60	100
GE 103	Engineering Chemistry	<u>48</u>	<u>06</u>	3	40	60	100
GE 104	Fundamentals of Electrical and Electronics Engineering	<u>36</u>	<u>5</u>	3	40	60	100
GE 105	Engineering Drawing-I	<u>27</u>	<u>51</u>	3	40	60	100
PT 101	Fundamentals of Polymer Science	<u>48</u>	<u>06</u>	3	40	60	100
	Total (18 weeks-18½ Hours per week)	<u>255</u>	<u>80</u>	18	240	360	600
		<u>335</u>					
PRACTICAL							
GEL 106	Electrical and Electronics Engineering Lab	<u>27</u>		4	50	50	100
GEL 107	Engineering Chemistry Lab	<u>40</u>		4	50	50	100
PTL 101	Workshop Practice-I	<u>111</u>		8	100	100	200
	Library	<u>27</u>		-	-	-	-
	Total (18 weeks-11½ Hours per week)	<u>205</u>		16	200	200	400

SEMESTER – II

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
GE 201	Communication English-II	<u>48</u>	<u>06</u>	3	40	60	100
GE 202	Applied Mathematics	<u>48</u>	<u>06</u>	3	40	60	100
GE 203	Fundamentals of Computer Engineering	<u>48</u>	<u>06</u>	3	40	60	100
GE 204	Engineering Drawing-II	<u>27</u>	<u>40.5</u>	3	40	60	100
GE 205	Engineering Physics	<u>48</u>	<u>06</u>	3	40	60	100
PT 201	Plastics Materials – I	<u>48</u>	<u>06</u>	3	40	60	100
	Total (18 weeks-19 Hours per week)	<u>267</u>	<u>70.5</u>	18	240	360	600
		<u>337.5</u>					
PRACTICAL							
GEL 206	Engineering Physics Lab	<u>40.5</u>		4	50	50	100
PTL 203	Utilities and Service Equipments Lab	<u>54</u>		4	50	50	100
PTL 204	Workshop Practice -II	<u>81</u>		8	100	100	200
	Library	<u>27</u>		-	-	-	-
	Total (18 weeks-11 Hours per week)	<u>202.5</u>		16	200	200	400

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

DIPLOMA IN PLASTICS TECHNOLOGY SYLLABUS

SEMESTER – III

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PT 301	Plastics Materials – II	48	06	3	40	60	100
PT 302	Plastics Processing Technology – I	48	06	3	40	60	100
PT 303	Plastics Testing – I	48	06	3	40	60	100
PT 304	Additives and Compounding	36	40.5	3	40	60	100
	Total (18 weeks-11 hours per week)	180	22.5	12	120	240	400
		202.5					
PRACTICAL							
PTL 305	Plastics Processing Lab - I (18 weeks – 10 hours a week)	176.5		8	100	100	200
PTL 306	Plastics Testing Lab – I (18 weeks – 7.5 hours a week)	134		8	100	100	200
	Library	27		-	-	-	-
	Total (18 weeks-19 hours per week)	337.5		16	200	200	400

SEMESTER - IV

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PT 401	Fundamentals of Plastics Product and Mould Design	48	06	3	40	60	100
PT 402	Plastics Processing Technology-II	48	06	3	40	60	100
PT 403	Plastics Testing – II	36	4.5	3	40	60	100
PT 404	Polymer Composites and Applications	36	4.5	3	40	60	100
	Total (18 weeks-10½ hours per week)	168	21	12	160	240	400
		189					
PRACTICAL							
PTL 405	Plastics Processing Lab – II Total (18 weeks-9 hours per week)	162		8	100	100	200
PTL 406	Plastics Testing Lab -II Total (18 weeks-6 hours per week)	108		8	100	100	200
PTL 407	CAD Lab Total (18 weeks-3 hours per week)	54		-	-	-	-
	Library	27		-	-	-	-
	Total (18 weeks-19½ hours per week)	351		16	200	200	400

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

DIPLOMA IN PLASTICS TECHNOLOGY SYLLABUS

SEMESTER V

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PT 501	Advanced Plastics Processing	<u>48</u>	<u>6</u>	3	40	60	100
PT 502	Maintenance of Plastics Processing and Testing Equipments	<u>36</u>	<u>4.5</u>	3	40	60	100
PT 503	Mould Manufacturing	<u>48</u>	<u>6</u>	3	40	60	100
	<u>Total (18 weeks-8½ hours per week)</u>	<u>132</u>	<u>16.5</u>	9	120	180	300
		<u>148.5</u>					
PRACTICAL							
PTL 504	Plastics Processing Lab - III <u>(18 weeks - 11 hours a week)</u>	<u>202.5</u>		8	100	100	200
PTL 505	Plastics Testing Lab - III <u>(18 weeks - 9 hours a week)</u>	<u>162</u>		4	50	50	100
	Library	<u>27</u>		-	-	-	-
	<u>Total (18 weeks-21½ hours per week)</u>	<u>391.5</u>		12	150	150	300

SEMESTER VI

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PT 601	Plastics Recycling and Waste Management	<u>36</u>	<u>4.5</u>	3	40	60	100
PT 602	Industrial Management and Entrepreneurship	<u>36</u>	<u>4.5</u>	3	40	60	100
	<u>Total (18 weeks-4½ hours per week)</u>	<u>72</u>	<u>9</u>	6	80	120	200
		<u>81</u>					
PRACTICAL							
PTL 603	Maintenance of Plastics Processing and Testing Machinery <u>(18 weeks – 4½ hours a week)</u>	<u>81</u>		4	50	50	100
PTL 604	Project Work <u>(18 weeks – 19½ hours a week)</u>	<u>351</u>		8	100	200	300
	Library	<u>27</u>		-	-	-	-
	<u>Total (18 weeks-25½ hours per week)</u>	<u>459</u>		12	150	250	400

CH-Contact Hours

TH-Tutorial Hours

EH- Examination Hours

**DPT
SEMESTER – I**

GE101-COMMUNICATION ENGLISH-I (54 Hours)

Unit I (10½ Hours)

Grammar- Parts of Speech; Voice; Direct and Indirect speech; Tenses; Infinites, Gerunds, Prepositions, Question tag, One-word substitute, Articles, Adverb, Punctuation,

Unit II (10½ Hours)

Letter writing-Personal letters (letter to your friend inviting to birthday party, letter to your father asking him to permit to join Education Tour, letter from a son/daughter to his/her father stating how he/she hopes to fare in the approaching Diploma Examinations, letter to a friend offering suggestions as to what to do after completing the Diploma course)

Unit III (12 Hours)

Composition (Simple passage related to topics such as Environment, Moral story, Science & Technology, about A Favorite Place, Hobbies, School life etc), Common Errors (Noun, pronoun, articles, adverb, prepositions etc.), Correction of sentences;

Unit IV (10½ Hours)

Dialogue writing; Note-making; Essay writing (Related to Environment and Science & Technology); Writing Instructions (Imperatives/ 'Should' form), Sending communication through E-mail (All Personal letters)

Unit V (10½ Hours)

Hints Development, Filling forms (Bank challan, application for bank loan Railway ticket booking)

Phrases: At all; Instead of; In spite of, As well as; Set up; Upset; Look up; Call off; Call out; Come across; Set right, Sending communication through E-mail.

Idioms: Work up(excite); Break down; Stand up for; Turn down; Pass away; Pass on; Back up; back out Carry out; done for (ruined);Bring about; Go through; Ran over; Look up(improve); pick out (selected)

Text /Reference Books

1. Viswamohan, Aysha. English for Technical Communication. Tata McGraw – Hill, New Delhi.2008.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi.2006.

3. A.S. Hornby, "The Advanced Learners dictionary of Current English" Oxford University Press,2004.
4. Wren and Martin,"High school English Grammar and Composition". S.Chand & ., Ltd.
5. Glennis Pye, 'Vocabulary in Practice – Part 1 to4', Cambridge University Press,2004.
6. Raymond Murphy, " Essential English Grammar", Cambridge University Press, 1990.
7. Michael Swan "Basic English Usage", EBS/OUP, 1989.
8. Mishra , "Communication Skills for Engineers " 1st Edition Pearson Longman.
9. M.Thomas, "Common Errors in English", Lotus Press, New Delhi,2006.
10. Shiv K Kumar & Hemalatha Nagarajan, " Learn Correct English", Pearson Longman.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – I**

GE 102 – ENGINEERING MATHEMATICS (54 Hours)

Unit I Algebra (10½ Hours)

Determinants - Expansion of determinants up to third order - properties of determinants - Solution of simultaneous equations using Cramer's rule.

Matrices -Introduction - Definition - Types of matrices - Operations on matrices.

Binomial Theorem: Introduction to permutation and combination - Definitions - Values of ${}^n P_r$ and ${}^n C_r$. Binomial theorem for a positive integral index

Unit II Complex Numbers (10½ Hours)

Introduction - Definition, real and imaginary parts, conjugates, modulus and amplitude form, multiplication and division of complex numbers .Argand diagrams - Collinear points, four points forming square, rectangle, rhombus and parallelogram. Simple problems. Demoivre's theorem - related problems.

Unit III Analytical Geometry (10½ Hours)

Pair of straight lines: Pair of lines passing through origin - $ax^2 + 2hxy + by^2 = 0$ expressed in the form $(y-m_1x)(y-m_2x)=0$. General equation of the second -degree. $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$, to represent pair of straight lines. Condition for second degree equation to represent pair of lines.

Circles : Equation of circle - Given centre and radius - General equation of circle finding center and radius, equation of circle described on the line joining the points (x_1, y_1) and (x_2, y_2) as diameter with simple problems.

Unit IV Trigonometry (10½ Hours)

Compound angles: Expansion of $\sin(A \pm B)$, $\cos(A \pm B)$ and $\tan(A \pm B)$ problems; solving the above expansions.

Multiple Angles: Trigonometrical ratios of multiple angles ($2A$ and $3A$ only) and sub-multiple angles - Simple problems.

Unit V Differential Calculus (12 Hours)

Limits: standard results

$$\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}, \lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$$

Differentiation: Definition - Differentiation of x^n , $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\operatorname{cosec} x$, $\log x$, e^x , $u \pm v$, $kv + c$, uv , uvw , u/v . Problems using the above results.

Successive differentiation: Successive differentiation and formation of differential equations up to second order.

Text / Reference Books

1. Mathematics for Polytechnic Colleges (First Semester) -P.Krishnamurthy, N.Thangasamy.
2. Higher Secondary Mathematics - First Year - Tamil Nadu Text Book Cooperative Society.
3. Engineering Mathematics - Dr.M.K.Venkatraman, National Publishing Co, Chennai.
4. Engineering Mathematics - Dr.P. Kandasamy& Others, schand& co Ltd., New Delhi.

Note: Minimum of one assignment is mandatory from each unit.

DPT
SEMESTER – I

GE 103 – ENGINEERING CHEMISTRY (54 Hours)

Unit I – STRUCTURE AND BONDING (13½ hours)

Basic Concepts of Atomic Structure: Atoms, Constituents of the atom, Bohr's model, molecules, valency, atomic weight, molecular weight, concept of orbit, orbitals. Modern periodic law-classification of elements based on electronic configuration.

Chemical Bonding: Theory of valency- ionic bonding, covalent bonding- (with examples for formation of simple compounds. Coordinate covalent bonding & hydrogen bonding.

Acids & Bases: Concept of acids & bases - pH & pOH concept - pH scale-Buffer solutions.

Water Chemistry: Hard & soft water - causes for hardness - types of hardness - simple methods to remove hardness in water - disadvantages of hard water.

Unit II – ORGANIC CHEMISTRY AND FUELS (13½ hours)

Fundamentals of Organic Chemistry: Difference between organic & inorganic compounds - uniqueness of carbon - catenation - saturated & unsaturated compounds. Functional groups - classification of organic compounds based on functional groups - isomerism.

Fuels: Definition - types of fuels - advantages of gaseous fuels - calorific value - crude oil - distillation - extraction of petroleum products using fractional distillation method- knocking & its prevention - octane number.

Unit III – ELECTROCHEMISTRY (13½ hours)

Solutions: Solute - solvent - solution - concentrated solution - dilute solution - saturated solution. Preparation of normal, molar & percentage solutions.

Electrochemistry: Electrolytes - classification - electrolysis & electroplating with mechanism - application. Cells & batteries - galvanic cell- Daniel cell. Corrosion - causes, disadvantages & prevention methods.

Fundamental in Thermodynamics: Thermodynamic terms - system, surrounding and types of systems open, closed & isolated - Extensive & intensive properties. Reversible & irreversible processes - exothermic & endothermic reactions-Types of thermodynamic processes - first law - definition & expression-Heat & work concept with expression.

Unit IV - ENGINEERING MATERIALS (13½ hours)

Engineering Materials: Definition, classification, properties and uses of the following engineering materials - abrasives, ceramics, ferrous and nonferrous metals, adhesives

Plastic Materials: Thermoplastics – Thermoset and Thermo plastics & their differences

Rubber Materials: Natural rubber - Preparation from latex - Disadvantages of natural rubber, Synthetic rubber – Preparation. Need for vulcanization.

Text / References Books

1. Text book of Engineering Chemistry - Jain & Jain, Dhanpat Rai & Co. New Delhi.
2. Text book of Organic Chemistry - Bahl - Arun Bahl.
3. Text book of Inorganic Chemistry - P.L. Soni, Sultan Chand & Co., Delhi.
4. Essential topics in Physical Chemistry - Bhal, Tuli & Madan, Sultan Chand & Co., New Delhi.
5. A Text book of engineering chemistry – M.M. Uppal , Khanna publishers Delhi.

Note: Minimum of one assignment is mandatory from each unit.

DPT
SEMESTER – I

GE 104 - FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING (41 Hours)

Unit I: DC & AC Circuits: (9 Hours)

Definitions – Electric current, voltage and resistance – Ohm's Law and Kirchhoff's Laws – Resistance in series, parallel – Simple problems – Electromagnetism, Magnetic flux, Flux density, Magnetic field Intensity, MMF, permeability, reluctance, Faraday's laws of electromagnetic Induction.

Fundamentals of AC voltage and current – Peak, average, RMS value of sine wave, Frequency, time period, amplitude, power, power factor, Single Phase/ 3 phase connection, Delta Connections - relationship between phase and line voltages, current in star and Delta connections.

Unit II: DC Generator, DC Motor: (9 Hours)

DC Generator & DC Motor - Construction – Principles of operation, types and applications, Emf equation of Dc machine, Necessity for starter, three points, four point starters.

UNIT III: AC machines: (7½ Hours)

Transformer– Types of transformers (Current & Voltage) - principle of operation and construction EMF equation – losses in a transformer – efficiency.

Principle of operation of single phase capacitor start induction motor – applications – three phase induction motors – squirrel cage and slip ring IM (construction and working principle)

Unit IV : Special motor and electrical safety: (8 Hours)

Special Motor: PMDC, Servo motors – construction, working principle and application. Electrical Safety – Importance of earthing & Megger – Electric shock – First aid for electric shock – Precautions against shock – Cause of accidents and their preventive measures – Energy conservation & Energy Management

Unit V : Basic Electronics and Logic Gates: (7½ Hours)

Semiconductor materials – N type and P type – PN Junction – forward and reverse bias, characteristics of PN junction diode – Half wave rectifier, full wave rectifier, bridge rectifier,. Transistor – construction of NPN and PNP types.

Logic Gates – positive and negative logic, definition, symbol, truth table, Boolean expression for OR, AND, NOT, NOR, NAND, EXOR and EXNOR gates & its basic application.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – I**

GE 105 – ENGINEERING DRAWING – I (78 Hours)

Unit I (18 Hours)

The Importance of Engineering Graphics: Explanation of the scope and objective of Engineering Drawing – its importance as a graphic communication- need for preparing drawing as per standards – BIS, SP 46.

Drawing Instruments: Basic drawing instruments – Mini drafter – Setsquare – compass - dividers – drawing boards – Pencils – Drawing papers– French curves – Stencils – Selection and method of using them.

Drawing Standards: Size of drawing sheets – Layout of drawing sheet – Title Blocks – Types of lines – Folding of drawing sheets.

Free hand Lettering and Numbering: Need for legible lettering and numbering on drawings – selection of suitable size of lettering for different drawing, writing of Engineering drawing titles and notes using both vertical and sloping styles.

Dimensioning: Function of dimensioning - need for dimensioning - engineering drawing according to BIS – Notation used in dimensioning – Dimension line – Extension line – Arrow heads and leader – System of dimensions - Method I and Method II.

Geometric Construction: Construction of regular polygon - given the length of its side, Conics-construction of ellipse, parabola and hyperbola by eccentricity method, construction of cycloid, construction of involutes of square and circle, drawing of tangents and normal to the above curves.

Unit II (27 Hours)

Principles of Orthographic Projection: Explanation of the meaning of orthographic projection using a viewing box and a model- number of views obtained need of only three views for displaying the object - explanation of the meaning of first angle and third angle projection – symbol of projection-Front view, top view and side view-sketching these views for a number of engineering objects

Unit III (15 Hours)

Projection of Points, Lines and Planes: Projection of points in different quadrants, projection of straight lines parallel to one or both planes, parallel to one plane – perpendicular to other – inclined to one plane and parallel to other line inclined to both planes (in first quadrant). Methods of finding true length and its inclination with the reference planes. Projection of planes and polygonal surface – parallel to one plane and perpendicular to other plane (in first quadrant).

Unit IV (18 Hours)

Projection of Solids : Projection of simple solids like prism, pyramid, cylinder and cone when the axis is parallel to one plane and perpendicular to other plane in first quadrant.

Text / Reference Books

1. Engineering Graphics, Julyes Jaisingh.
2. Engineering Drawing – K.V. Natarajan.
3. Engineering Graphics – K. C. John.
4. Engineering Graphics – P. I. Varghese.
5. Engineering Drawing – Venugopal.
6. Engineering Drawing – M.B. Shah & B.C.Rama.
7. Engineering Drawing – N.D. Bhatt , Charotar Publishing House.
8. Machine Drawing – Lakshminarayan & Mathur , Jain Brothers .

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – I**

PT 101 – FUNDAMENTALS OF POLYMER SCIENCE (54 Hours)

Unit – I Introduction to Polymer Science (10½ Hours)

The science of large molecules – Definitions – Monomers & its requirement- Broad Classifications of Polymers - Types based on Structure- Processing and Applications - Molecular Force and Chemical Bonding in Polymers –Polymer structure – Homo Polymers and Copolymers – Geometric Isomerism – Tacticity – Nomenclature – Molecular Weight and Distribution and its effect on Properties and Processing of Polymers- Thermal Transition – Tg and Tm.

Unit – II Polymerization (16½ Hours)

Chain growth Polymerization – Addition Polymerisation – Reaction Mechanism - Free Radical Reaction – Ionic Reaction – Coordination Polymerization – Ring Opening Polymerization - Condensation Polymerization – Degree of Polymerisation – Polymerization Techniques – Bulk, Solution, Suspension and Emulsion Polymerization - Co-polymerization.

Unit – III Polymer Structure and Properties (13½ Hours)

Structure – Property Relationship – Molecular Weight and Poly Dispersity Index (PDI) - Effect of Polymerization on PDI – Polymer solutions and solubility – General Rules for Polymer solubility – solubility Parameters, Properties of Dilute solutions - Solid state properties – State of Polymer – Crystalline, Amorphous, Semi-crystalline, Liquid crystalline
– Requirement of Crystallinity – factors affecting crystallinity. Deformations in Polymer – Mechanical properties - Stress – Strain behavior – Polymer Fracture and Toughness – Cracking & Crazing – Thermal & Electrical properties.

Unit – IV Polymer Characterization (13½ Hours)

Identification of Polymers – Simple Spectroscopic Methods – Molecular Weight Determination – Measuring Dilute Solution Viscosity – Gas Chromatography – Gel Permeation Chromatography – Melt Flow Characteristics - Thermal Analysis DSC and TGA
– Dynamic Mechanical Analysis.

Text / Reference Books

1. Polymer Science – Gowariker V.R. & others.
2. Text book of Polymer Science – Billmeyer F.W.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – I****GEL 106– ELECTRICAL AND ELECTRONICS ENGINEERING LAB (27 Hours)****1. Electrical Engineering Lab (13½ Hours)**

1. Study of measuring instruments – Ammeter – Volt meter – Watt meter etc.
2. Determination of unknown resistance by Ohm's Law.
3. Energy measurement in a single phase circuit using lamp load.
4. Power measurement in a single phase circuit.
5. Load test on a single phase transformer.
6. Load test on a single phase induction motor.
7. Verification of series and parallel circuit.
8. Study of DC & AC machine starters.

2. Electronics Engineering Lab (13½ Hours)

1. Characteristics of PN junction diode.
2. Characteristics of transistor.
3. Construction of bridge rectifier.
4. Verification of Logic gates.
5. Characteristics of Photo Diode, LED and thermister & zenerdiode.
6. Measurement using CRO and megger.
7. Study of microprocessor, microcontroller & drives.

Text / Reference Books

1. Principles of Electrical and Electronics Engineering by V.K.Mehta, S.Chand & Publications
- 2, Electronic Devices and Circuits, Sanjeev Gupta, Dhanpat Rai Publications

**DPT
SEMESTER – I**

GEL 107 – ENGINEERING CHEMISTRY LAB**(40 Hours)****1. Volumetric Analysis****Acidimetry - Alkalimetry**

- (a) Estimation of Hydrochloric acid
- (b) Estimation of Sulphuric acid
- (c) Estimation of Sodium hydroxide given standard sodium carbonate solution & Hydrochloric acid as a link solution)

2. Permanganometry

- (a) Estimation of potassium permanganate
- (b) Estimation of strength of Oxalic acid

3. EDTA Titration

- (a) Estimation of total hardness of water for the water sample

4. pH Determination

- (a) Determination of pH using pH meter

5. Preparation of Standard Solutions

- (a) Preparation of 1N, 0.5N & 0.1N solution of sodium carbonates
- (b) Preparation of 1N solution of oxalic acid

Text / Reference Books

1. Practical Chemistry for Class 11th and 12th, S. Chand Publishers.
2. ISC Practical Chemistry for Class 11th and 12th by S.P. Sharma, S.Chand Publishers.

**DPT
SEMESTER – I**

PTL 101 – WORKSHOP PRACTICE**(111 Hours)****Workshop Safety****(6 Hours)**

General shop floor safety, safety on fitting bench and safety on machines, handling of machinery and materials

1. Familiarization of Workshop Tools**(13½ Hours)**

Hand tools, Marking tools: Scribes, compass, dividers, outside and inside caliper, hermaphrodite caliper, ordinary scribing block, universal scribing block, angle plate, V-block, centre punch, dot punch, prick punch, try square, beveled try square, surface plate, straight edge, combination set.

Cutting tools: Chisels – flat, crosscut, half round, diamond point.

Files: single cut and double cut files- rough, bastard, medium, smooth, dead smooth files – flat, square, pillar, round, triangular, half round, knife and needle files, rifler files (spoon file).

Hack saw: Types of frame - Solid frame and adjustable frame – blades of different grade.

Striking tools: Ball peen, Straight peen, Cross peen, Steel hammers and Double-faced plastics hammers (soft hammer).

Holding devices: Bench vice, hand vice, swivel base vice

Miscellaneous tools: screwdrivers, Open end spanner, double end spanner, adjustable spanner, box spanner and ring spanner

2. Study and Practice on Measuring Instruments/Equipments**(13½ Hours)**

Measuring instruments: Construction, application and least count, steel rule - try square - vernier calipers - Micrometers-outside and inside - depth gauges - height gauges - slip gauges.

Geometrical measurements: Straightness, Flatness, Parallelism, Squareness, Concentricity.

Standard Gauges: Type of gauges, Radius gauges, Feeler gauges, Screw pitch gauge, Taper gauge & Thickness gauges.

3. Filing and Fitting Practice**(48 Hours)**

Filing Exercise: Balancing of hand file, producing flat surface, making parallel surface, making perpendicular surface, radius filing, and taper filing, maintaining dimension.

Universal fitting: Filing to maintain overall size- Hacksaw cutting, finishing by filing, filing to maintain fit between male and female pieces.

Template making practice: to make profile geometry by cutting and filing.

Cube fitting: Filing to maintain overall size – filing square hole in the middle – filing a cube to suit the square hole with slide fit.

4. Pedestal Grinding

(15 Hours)

Sharpening of Cutting Tools - Single point and Knife tools, Form Tools, Parting and Grooving Tools, Thread Cutting Tools.

5. Practice on Drilling Machine

(15 Hours)

Familiarization with Drilling Machine - Principal parts, work holding device, Cutting Tools & Tool holding device.

Marking and Punching the layout. Drilling and Tapping.

Drilling and Reaming.

Counter boring and Counter sinking.

**DPT
SEMESTER – II**

GE 201- COMMUNICATION ENGLISH-II (54 Hours)

Unit I (10½ Hours)

Grammar – Changing of sentence into negative without changing the meaning; Writing definitions; Composition – Conversion of graphics (pie-chart, bar-chart, table, Flow Chart).

Unit II (10½ Hours)

Degrees of comparison; Letter writing – Business and official letters (Letter of quotation, letter of clarification, letter placing orders).

Unit III (10½ Hours)

Sequencing of jumbled sentences; Answering the verbal questions in affirmative and negative; Letter writing- Letter for seeking permission for industrial visit, Letter to the Editor, Inviting a VIP.

Unit IV (10½ Hours)

Synonyms and Antonyms; Spelling and Punctuations; forming meaningful sentences for the words given; Letter writing- Letter of (request for leave, Bonafide certificate, testimonials); Check list.

Unit V (12 Hours)

Writing purpose statements ; Concord; Modal verbs; Letter writing – letter of application for a job with Bio-data/ Curriculum Vitae; Sending the job application through e-mail (along with the attachment); Technical Report writing (Analytical report, Project report, inspection report, production report, investigation report, field report).

Text/Reference Books

1. Viswamohan, Aysha. English for Technical Communication. Tata McGraw –Hill, New Delhi.2008.
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi.2006.
3. A.S. Hornby, "The Advanced Learners dictionary of Current English" Oxford University Press,2004.
4. Wren and Martin,"High school English Grammar and Composition". S.Chand&co., Ltd.
5. GlennisPye, 'Vocabulary in Practice – Part 1 to 4', Cambridge University Press,2004.
6. Raymond Murphy, " Essential English Grammar", Cambridge University Press, 1990.
7. Michael Swan "Basic English Usage", EBS/OUP, 1989.
8. Mishra , "Communication Skills for Engineers " 1st Edition Pearson Longman.
9. M.Thomas, "Common Errors in English", Lotus Press, New Delhi,2006.
10. Shiv K Kumar &HemalathaNagarajan, " Learn Correct English", Pearson Longman.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

GE 202 - APPLIED MATHEMATICS (54 Hours)

Unit I: Vector Algebra (10½ Hours)

Introduction - Definitions-Types-addition and Subtraction of Vectors-Properties-position vector .Direction cosines and direction ratios of vectors. Simple problems.

Product of Vectors - Scalar and vector product of two vectors - Angle between two vectors

Applications of vectors - Work done-moment - Scalar and vector triple product

Unit II: Integral Calculus (12 Hours)

Integration - Definition - Integral values using reverse process of differentiation. Integration using decomposition method. Integration by substitution - Integrals of the form

$$\int [f(x)]^n f'(x) dx, n \neq -1.$$

$$\int f'(x)/f(x) dx, \int [f(x)] f'(x) dx$$

Standard Integrals - Integral of the form $\int dx/(a^2 \pm x^2)$, $\int dx/x^2 - a^2$, $\int dx/\sqrt{a^2 - x^2}$

Integration by parts - Integration by parts and Bernoulli's form to evaluate $\int x \sin nx dx$, $\int x \cos nx dx$, $\int x^2 e^{ax} dx$, $\int x^n \log x dx$, $\int \log x dx$.

Unit III : Applications of Differentiation (10½ Hours)

Velocity and Acceleration - simple problems - Maxima and Minima of single variable - simple Problems. Partial differentiation of two variables up to second order – simple problems.

Unit IV: Applications of Integration (10½ Hours)

Definite integral, Area and volume - Area of circle, Volume of sphere and cone – Simple problems. Solution of differential equations - variable separable

Unit V: Probability & Statistics (10½ Hours)

Definitions - Axioms - addition formula, mutually exclusive event, addition Theorem on Probability, conditional probability - Multiplication theorem.

Random Variable - Types of random variable- Definition of Discrete Random Variable, probability mass function, continuous random variable and probability density function – simple problems .Mathematical expectation of discrete random variable, simple problems.

Discrete Distributions - Binomial Distributions - Expression for mean, variance and standard deviation - simple problems.

Text / Reference Books

1. Applied Mathematics for Polytechnic Colleges (Second Semester) - P.Krishnamurthy, N.Thangasamy.
2. Higher Secondary - First Year - Tamil Nadu Text Book Cooperation.
3. Engineering Mathematics - Dr.M.K.Venkatraman, Natinal Publishing Co, Chennai.
4. Engineering Mathematics - Dr.P. Kandasamy& Others, schand& co Ltd.,New Delhi.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

GE 203 – FUNDAMENTALS OF COMPUTER ENGINEERING (54 Hours)

Unit 1 (10½ Hours)

Introduction to Computer – Generation of computers-classification-Central Processing Unit (CPU), Memory Unit, Input/ Out Devices : Keyboard, Mouse (Optical), Digitizer, Scanner, Web Camera, Monitor (CRT, TFT) , Printers, Plotters, Bar Code Reader, Secondary Storage Devices-Floppy, Hard Disk, CD, DVD, Flash Drive, Block Diagram Showing Interconnection of Computer Parts

Operating System - Definition of Operating System (OS), Types of OS- Single user, Multi user, Multi Programming, Time Sharing, Multi Processing,

Unit 1 (16½ Hours)

Introduction to Windows - Windows Environment, Parts of Windows Screen- Icon, Menu, Start Menu Minimizing, Maximizing, Closing Windows, Windows Explorer, Recycle Bin, Clipboard, My Computer, My Network Places, Control Panel- Adding New Hardware and Software, Display, Font, Multimedia, Mouse, International System, Accessories- Paint, Media Player, Scan disk, System Information

Unit 1 (16½ Hours)

Information Processing-Word processor- Introduction to MS-Word, Starting MS-Word, Special Features of MS- Word, Using Help, Opening Document, Typing and Editing, Copying, Inserting, Moving, Deleting ,Copying from One Document to Others , Undo, Redo, Spell Check, Find and Replace, Formatting; Characters and Fonts, Spacing, Removing Characters Formatting, Inserting Symbols, Paragraphs. Page Setting, Header and Footer, Page Breaks, Borders and Shading

Power Point -Introduction to Power Point, Creating a Presentation/Slide, Adding Animation in Slide, Running a Slide Show

Unit 1 (10½ Hours)

Computer and Communication- Need of Data Transmission, Data Transmission Media, Baud rate and Bandwidth, Digital and Analog Transmission, Serial and Parallel Data Transfer, Protocols, MODEM. Networking of Computers- LAN, WAN, MAN, Blue tooth, LAN Topologies- Bus, Star, Ring, Hybrid, Introduction to Ports- RS232, IEEE 488, PS2, USB, UTP.

Internet-Introduction to Internet, Bridges, Routers, Switch, Gate way, www, Web Site, URL, e-mail, e-Commerce, Web browsing, Web page, Introduction to Hyper text & HTML, Introduction to http & ftp Protocol.

Text / Reference Books

1. Computer Fundamental V.K. Jain, Standard Pub.& Distributors
2. Rapindex Computer course , Jayant pushtak mandal, Neogy.
3. Simplex Computer course –Ravi kant Taxali, Tata McGraw hill

Note: Minimum of one assignment is mandatory from each unit.

Text / Reference Books

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, (2006).
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press (2005).
3. Mehta V K, “Principles of Electronics”, S.Chand & Company Ltd, (1994).
4. B.L. Theraja, Fundamentals of Electrical and Electronics Engineering, S.Chand & Co.
5. T. Thiyagarajan, Fundamentals of Electrical and Electronics Engineering, Scitech a. Publicatiuons (India) Pvt.ltd.
6. Mikell P. Groover, Automation, Production System and Computer Integrated Manufacturing, Edn. 2 Published by Pearson Education (Singapore) Pte. Ltd., Indian Branch, 2842 F.I.E., Patparganj, Delhi 110 002, India.
7. KB Raina & S.K.Battachariya, Electrical Design Estimating and Costing, Edn. 6, Tata McGraw Hill Publishing Co., 7, West Patel Nagar, New Delhi 110 008.
8. Gary Dummy, Introduction to Programmable logic controls, Thomson Debnar learning second edition second reprint 2003.
9. B.L.Theraja & A.K. Theraja, Electrical Technology Vol. I & II, Edn. 23, published by S.Chand & Co. Ltd., Ram Nagar, New Delhi 110 055.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

GE 204 – ENGINEERING DRAWING – II

(67½ Hours)

Unit I

(18 Hours)

Sectional views of objects

Need for sectional drawing of an engineering object- Sectioning of solids in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, obtaining true shape of section.

Auxiliary views

Need of auxiliary views – auxiliary views given engineering drawings

Development of surfaces

Development of lateral surfaces of simple and truncated solids- prisms, pyramids, cylinders and cones- development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

Unit II

(18 Hours)

Pictorial drawings

Principles of isometric projection, construction of isometric scales- Isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones -isometric projection of simple Engineering.

Perspective drawing

Principle of perspective projection – Type of perspective projection – Perspective projection of prisms, pyramids and cylinders by visual ray method.

Unit III

Fastening Devices

(9 Hours)

Basic Fastening Devices - Temporary and permanent fastenings - areas of applications - Bolts and nuts - different types of bolted joints for different applications - purpose of locking nuts - types of lock nuts. Exercises in drawing bolted connection using standard proportion. Exercises in the selection of appropriate fastening devices to meet the given working conditions

Unit IV

Assembly and Detail Drawings of Machine Part

(22½ Hours)

Need and functions of assembly and detailed drawings – selection of sheet sizes – preparation of title block – bill of materials and parts list, Amendments lists –Steps in preparing assembly and detailed drawings.

Exercises in assembly and detailed drawings of sleeve & cotter joint, socket & spigot joint , knuckle joint, muff coupling, half lap muff coupling , protected flanged coupling, Plummer block, Tail stock and Screw jack.

Text / Reference Books

1. Engineering Graphics, Julyes Jaisingh.
2. Engineering Drawing by N. D Bhutt.
3. Engineering Graphics by P. I. Varghese.
4. Machine Drawing by P.I. Varghese & K.C. John.
5. Machine Drawing by N.D. Bhatt.
6. A test book of Machine Drawing by V. Lakshmi Narayan.
7. Machine drawing by K.R. Gopalakrishna.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

GE 205 – ENGINEERING PHYSICS

(54 Hours)

Unit I UNITS & DYNAMICS

(13½ hours)

Units and Dimensions- Fundamental quantities and derived units, systems of units (SI,CGS,FPS)- Dimensional Formula for area , volume, density, velocity, momentum, acceleration, force, impulse, work & power- Dimensional equation – Derivation of expression of period of simple pendulum using dimensions.

Dynamics-Scalar and vector quantities- Addition and Subtraction of vectors (Triangle method) - Resolution of vectors into two mutually perpendicular vectors

Force and motion-Force-Addition of forces –Triangle law of forces- Lami's theorem- Momentum and Its Conservation- Speed, velocity and acceleration

Circular Motion- Relation between linear and angular distance, velocity and acceleration- Centripetal and Centrifugal force. Parabolic Motion-Time of flight of a projectile-Kinetic energy-Potential energy-Law of conservation of energy.

UNIT II – ELASTICITY AND SURFACE TENSION

(13½ hours)

Elasticity- Stress–strain - Hooke's law- Young's Modulus, Bulk Modulus, Rigidity modulus and Poisson's ratio – Determination of Young's modulus- Torsional pendulum

Surface Tension and Viscosity - Surface tension - Surface energy- Angle of contact- Relation between surface tension and surface energy- Determination of surface tension by capillary rise method. Viscosity-Coefficient of viscosity- Streamline and turbulent flow- Reynolds number- Poiseuille's formula- Stoke's formula-Terminal velocity.

UNIT III - HEAT

(13½ hours)

Temperature measurement - Centigrade, Fahrenheit and Kelvin scales of temperature measurement – Newton's law of cooling –Expansion of gases-Verification of Boyle's law & Charle's law- Specific heat of gas at constant volume and at constant pressure- Mayor's relation –Isothermal expansion of gas- Adiabatic expansion of gas- Postulates of Kinetic theory of gases.

Modes of heat transfer and their examples

UNIT IV - LIGHT

(13½ hours)

Optics - Snell's law of refraction- critical angle- Total internal reflection- Optical fiber- convex and concave mirrors- focus, image formation and concave lens-focal length, simple microscope- magnifying power- velocity of light- relation between velocity, wavelength and frequency of light.

Laser - Introduction- principle- population Inversion-Spontaneous and stimulated emission, optical pumping-characteristics- types of laser (not in detail) - applications.

Text /Reference Books

1. R.K.Gaur and S.L.Gupta "Engineering Physics', Dhanpat Rai Publications (All Units)
2. "Engineering Physics", P.Mani, Dhanam Publications
3. "Physics Part I & II", Halliday and Resnick
4. "Engineering Physics- I", R.Elangovan, M.Vijay Amirthraj and N.Karikalan, Mercury sun publications

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

PT 202 – PLASTICS MATERIALS – I (54 Hours)

Unit – I Natural Polymer (4½ Hours)

Nomenclature of Polymers – Sources of Raw Materials – Methods of Manufacture – General Characters & Properties, processing behaviour and applications of natural polymers such as Shellac Resin – Natural Rubber – Casein.

Unit – II Commodity Plastics - Olefinic & Styrenic Plastics (16½ Hours)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of

Low Density Polyethylene, Linear Low Density Polyethylene, High Density Polyethylene, High Molecular weight High Density Polyethylene, Polypropylene (Homo & Copolymer), Polystyrene, High Impact Polystyrene, Acrylonitrile Butadiene Styrene , Styrene Acrylonitrile Expanded Polystyrene

Unit – III Commodity Plastics - Vinyl & Cellulosic Plastics (16½ Hours)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of

Polyvinyl chloride & Chlorinated Polyvinyl chloride, Polyvinylidene Chloride, Polyvinyl Acetate, Polyvinyl Alcohol, Cellulose Nitrate, Cellulose Acetate, Cellulose Acetate Butyrate, Regenerated Cellulose. Polymethyl Methacrylate, Polyacrylonitrile, Thermoplastic Elastomers.

Unit – IV Thermoset Plastics (16½ Hours)

Source of Raw Materials – Methods of Manufacture – General Characters & Properties – Processing Behaviour and Applications of Phenol Formaldehyde – Urea Formaldehyde – Melamine Formaldehyde – Unsaturated Polyesters – Alkyd Resins – Epoxy Resin – Polyurethane – Silicones.

Text / Reference Books

1. Plastic Materials – J.A. Brydson.
2. Plastic Materials Hand Book – A.S. Athalye.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – II**

GEL 206 - ENGINEERING PHYSICS LAB

(40½ Hours)

1. Determination of thickness of a metal wire using screw gauge
2. Determination of diameter of a cylindrical bar using vernier calliper
3. Determination of time period of simple pendulum.
4. Experiment to verify Hook's law
5. Experiment to verify Lami's law
6. Determination of focal length of convex lens
7. Determination of focal length of concave lens
8. Determination of Young's modulus using non-uniform bending method
9. Determination of moment of inertia and rigidity modulus using torsional pendulum

Reference Books

1. "Engineering Physics Practical-I", Mercury sun Publications
2. "Engineering Physics Lab Manual", P.Mani, Dhanam Publications

**DPT
SEMESTER – II****PTL 203 – UTILITIES & SERVICE EQUIPMENTS LAB****(54 Hours)**

1. Study of Air Compressor Elements, Safety Features, Drive Mechanism, Lubrication.
2. Study of Hydraulic Pumps , Motors– Accumulators, Safety Features, Control Valves and Simple Hydraulic Circuits for Lifting Tackle, Manual Pump, Hydraulic Press, Hydraulic Valves – Different Types, Hydraulic Accumulators, Hydraulic Pressure Control and Flow Control, Hydraulic Piping and Coupling, Safety and Trouble Shooting.
3. Working of 4/2, 2/2 & 4/3 directional control valve in Single & Double Acting Cylinders.
4. Study of FRL unit and Air Dryer in Pneumatic System & Hopper Drier.
5. Study of heat exchangers in Moulding Machine.
6. Study of Mould Heating - Hot Oil Circulators.
7. Study of Chilling Plant/Cooling Tower.
8. Study of Electrical safety Measures & Demonstration about use of protective devices.
9. Study and Usage of Various Electrical Tools & Instruments like Voltmeter, Ammeter, Multimeter (Analogue and Digital), Wattmeter & Energy Meter & Meg ohm meter
10. Study of Single Phase and Three Phase power supply. Identification of phase, Neutral and Earth pits.
11. Importance of three phase wiring and its effectiveness, laying of three-phase wiring for an Electric Motor or any other three phase machine.
12. Study and Identification of common Electrical materials such as Wires, Cables, Switches, Fuses, Plugs, Connectors, Sockets etc.
13. Calculation of power and energy consumption.
14. Various types of protective devices such as: Wire Fuse, Cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multiple miniature circuit breakers, over and under current relays, contactors, and Different types of switches, MCCB.
15. Study of Fluorescent lamp and CFL.
16. Study of Servo Voltage Stabilizer.
17. Study of Half wave / Full wave rectifier.
18. Study of different types of heater used in plastics processing Machinery using Voltmeter & Ammeter find out the unknown wattage of heater.

**DPT
SEMESTER – II**

PTL 204 - WORKSHOP PRACTICES – II (81 Hours)

Workshop Safety (6 Hours)

General shop floor safety, safety on fitting bench and safety on machines. handling of materials

Practice on Lathe Hours) (27 Hours)

Familiarization with lathes- principal parts, work holding device, Cutting tools & tool holding device.

Plain turning and Step turning.

Taper turning.

Drilling and Reaming. Boring and counter boring. Thread cutting and knurling.

Practice on Milling Machine (21 Hours)

Familiarization with Milling Machine - Principal parts, work holding device, Cutting Tools & Tool holding device.

Plain surface Milling.

Slot Milling.

Pocket Milling.

Practice on Surface Grinding Machine (21 Hours)

Familiarization with Grinding Machine - Principal parts, work holding device, grinding wheels.

Plain Surface Grinding.

Slot Grinding.

Angular Surface Grinding.

Plumbing (6 Hours)

Pipe cutting and Thread cutting practice.

Coupling joint.

Elbow joint.

T - joint.

**DPT
SEMESTER – II**

PT 301 – PLASTICS MATERIALS – II (54 Hours)

Unit – I Engineering Plastics (21 Hours)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of Engineering Plastics

Polyoxymethylene, Polyamide (PA6, PA66, PA610, PA11, PA12 and PA46), Polyesters (PET, PBT), Poly Carbonate , Polyphenylene Oxide, UHMWHDPE, Polytetrafluoroethylene, Polyvinyl fluoride, Polyvinylidene fluoride, Thermoplastics Polyurethane

Unit – II Speciality Plastics (21 Hours)

Sources of Raw Materials – Method of Manufacture – General Characteristics & Properties – Processing Behaviour and applications of

Polysulphone,, Polyphenylene sulphide, Polyarylsulphone, Polyether Ketone, Polyether Ether Ketone, Polyimide, Polyamideimide, Liquid Crystal Polymers.

Unit – III Polymer Blends & Alloys (6 Hours)

Introduction to polymer blends & alloys - Definitions and nomenclature - reasons for making polymer blend - how to select blend components - preparation of alloys & blends - economy of blending.

Unit – IV Bio-degradable Plastics & Bio plastics (6 Hours)

Overview of Plastics degradation - Natural Bio-degradable Polymers - Synthetic Bio-degradable Polymers - Water soluble Polymers.

Text/ Reference Books

1. Plastics Materials – J.A. Brydson.
2. Plastic Materials Hand Book – A.S. Athalye.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – III**

PT 302 – PLASTICS PROCESSING TECHNOLOGY – I

(54 Hours)

Unit – I Introduction

(6 Hours)

Basic Principles of Melt Processing of Thermoplastics – Effect of Polymer Properties on Processing - Thermal Behavior of Polymer Melt - Rheology of Ideal Fluids and Polymers – Newtonian & Non-Newtonian fluids - Processing of Thermoset Plastics - Different Types of Processes - Description and Limitation - Processing Flow Chart - Selecting a Process – Degradation - Orientation – Process Advantage of Plastics over Conventional Materials.

Unit – II Injection Moulding Process

(16½ Hours)

Basic Process Principle - Machine rating and Specification - Types of Machines – Construction - Parts and its functions - Start-up and shut down procedure - Operation procedure - Clamping system - Type of Screw and its function - Heating System - Ejection system – Back Pressure - Suck back - Drooling - Nozzle Type - Process variables - Moulding cycle - Purging - Material recommendation - Microprocessor controlled Injection Moulding Machine- Shrinkage – Annealing - Dimensional Control - Moulding Record - Trouble Shooting - Injection Moulding of Thermosetting Materials – Automation - Introduction to Troubleshooting - Types of Injection Moulds - Two Plate Mould - Three Plate Mould - Cavity & Core finishing – Gate Types - Runner – Hot Runner Mould –Insulated Runner Mould system.

Unit – III Extrusion

(10½ Hours)

Introduction - principles - classification of extruders - single screw extruder - specification - screw nomenclature - types of screws - L/D ratio, compression ratio-back pressure - factors governing back pressure - output and factors affecting output-heating & cooling systems - breaker plate - screen pack & its functions - screw & hopper cooling-die entry effects and die exit instabilities - shark skin, melt fracture & bambooing.

Twin screw extruder - principle - types - process - merits & demerits - Vented barrel extruder - hopper loading devices - Drying equipments - Process, machinery - downstream equipments - dies for producing products such as - film - blow film, cast film - Sheets - Tubes and pipes, corrugated pipes - Mono filaments - Box strapping - Wire & Cable Coating / Lamination.

Unit – IV Blow Moulding (10½ Hours)

Basic principles – Process - Material requirement – Specification - Types of Blow Moulding - Processing parameters - Parison Programming - machine features - Design guideline for product performance & Appearance – Dies construction - Cycle time – Limitation - Part trimming & handling – blowing the parison - Melt Behavior – Clamping - Heating & cooling system - Mould venting -Faults - Causes & Remedies.

Unit – V Compression Moulding & Transfer Moulding (10½ Hours)

Principle – Process - Machine Specification - Material Recommendation - Bulk factor - Moulding powder - Preforms & Preheating Techniques - Process Variables - Flash Mould - Positive mould - Semi Positive mould - Flow Characters & Curing Time - Mould Heating & Cooling System - Types of Processes - Trouble Shooting - Moulding of Thermoplastic & Thermoset Material.

Principles of Transfer Moulding - Machine & Mould used - Moulding cycle - Press Capacity - Types of Transfer molding - Heating Requirements – Faults, Causes & Remedies - Comparison of Compression Moulding with Transfer Moulding.

Text / Reference Books

1. Injection Moulding Theory & Practice – Rubin, Irvin.
2. Plastics Engineering Hand Book – Society of Plastic Industry Inc.
3. Plastics Processing Data Hand Book – D.V. Rosato.
4. Plastics Materials & Processing – Brent Strong.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – III**

PT 303 – PLASTICS TESTING – I

(54 Hours)

Unit – I

Concepts of Testing & Identification of Plastics

(13½ Hours)

Basic concepts of testing - Specification and Standards - National and International Standards - Test specimen preparation - Pre-conditioning and test atmosphere.

Identification of plastics by simple tests - Visual examination - Density - Melting point - Solubility test - Flame test - Chemical tests, Density by Density-gradient column

Particle size by sieve analysis and moisture content analysis

Unit – II

Material Characterization

(10½ Hours)

Introduction - Melt Flow index – Viscosity – Dilute Solution Viscosity – Material Characterization Tests for Thermosets – Apparent (bulk) Density, Bulk Factor, Cup & Spiral Flow Test, Dynamic Viscosity (Brook field viscometer)

Unit – III

Mechanical Properties

(19½ Hours)

Short-term Mechanical Properties: Tensile properties - Flexural properties - Compressive properties - Shear properties - Impact properties - Tear resistance - Hardness - Abrasion resistance – Frictional properties

Long-term Mechanical Properties - Creep and Stress relaxation

Unit – IV Thermal Properties

(10½ Hours)

Introduction – Short Term Tests – Determination of Heat Distortion Temperature (HDT), Vicat Softening Temperature (VST) – Long Term Heat Resistant Tests – Thermal Conductivity – Thermal Expansion – Brittleness Temperature

Text / Reference Books

1. Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K..Nayak
2. Plastics Testing Technology Hand Book – Shah Vishu
3. Simple Methods for Identification of Plastics – Dietrich Braun

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – III**

PT 304 – ADDITIVES & COMPOUNDING (40½ Hours)

Unit – I Introduction to Additives (6 Hours)

Introduction - Technological Requirements - Classification - Chemistry and Mechanism - Selection Criteria - General effect on Properties - Evaluation and functions of additives.

Unit – II Additives (10½ Hours)

Antioxidants - Stabilizers (Heat & UV) - Plasticizers - Fillers and reinforcements - Impact Modifiers - Lubricants - Slip and Anti-block agents - Processing aids - Blowing agents - Flame Retardants - Anti-static and Conductive additives - Nucleating agents - Colourants - Additives for Recycling , Nano fillers

Unit – III Compounding Techniques (7½ Hours)

Selection of Polymers and Compounding ingredients - General objectives - possibilities and limitations of mixing and compounding - Method of incorporation of additives into polymer materials.

Unit – IV Compounding Equipments (10½ Hours)

Mixing and mixing equipments. Principles - Operating characteristics - Machine construction - Specifications - Process control systems and working details of Batch mixers and continuous mixers - High speed mixer - Two roll mill - Banbury Mixer - Ribbon blender - Planetary mixers - Single Screw extruder - Twin Screw extruders

Unit – V Plastics for Product applications (6 Hours)

Principles of Material selection, consideration of conventional materials competitive with plastics - Case studies on material suitability (e.g., Plastics Gears, Feeding Bottle, Bowels for micro wave ovens). Usage of plastics in major industries like Agriculture, Packaging, Building, Transport, Electrical, Electronics and Telecommunications, Medical and Furniture etc.

Text / Reference Books

1. Hand Book on Plastics Additives.
2. Plastic Materials - J.A. Brydson.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – III**

PTL 305 – PLASTICS PROCESSING LAB – I

(176.5 Hours)

Sl. No.	Name of M/c/ Equipment/ Mould	Description of Practical Exercise to be done*	Exercise Code No.	No. of Hours
1	Hand Operated Injection Moulding Machine	(i) Safety precautions to be taken in Shop floor	PP-01	<u>24</u>
		(ii) Study of machine in Idle-Run Observation (IRO), Parts & Functions, Operating Principles, Free Sketch of Machine parts e.g. Nozzle, Torpedo, Hopper, Rack & Pinion Barrel etc., shot capacity definition.		
		(iii) Operation practice to produce moulding on different hand injection moulds. Moulding Conditions, Recording the observation and results in practical record book.	PP-02	<u>22.5</u>
2	Compression moulding – Hand operated	(i) Study of hand compression moulding machine in IRO free sketch of parts & study of part function, comparison of compression moulding machine with injection moulding machine Compression moulding processes.	PP-03	<u>21</u>
		(ii) Operating principle of hand compression press, mould setting-procedure & parameter setting, operation practice on different compression moulds, Types of heating, machine specification observation and recording.	PP-04	<u>21</u>
3	Blow moulding Hand operated	(i) Study of hand Blow Moulding machines, free-sketch of M/c with parts & study of part function, specification of machine, Study of parison-die with sketch.	PP-05	<u>21</u>
		(ii) Die-centering practice, operation of hand blow machines to produce components - observations, cycle time analysis - procedure of operation and observations. Blowing requirement.	PP-06	<u>21</u>
4	Scrap Grinding	(i) Machine study in IRO, specification of machine, study of parts & function, line diagram of machine.	PP-07	<u>20</u>
		(ii) Operation-practice with different materials with different sizes and output study in Kg/hour for different materials.	PP-08	<u>21</u>
Two practical test on Plastic Processing Lab VIVA-VOCE			4 Hours Per Test 2 Hours	<u>2 Hours</u> <u>Per Test</u> <u>1 Hour</u>

* Practical exercises on operation of machines shall be done as per the operating manual instruction of the respective machines.

*One test may be conducted in the middle of the Semester and the other one at the end of the Semester followed by Viva-Voce.

**DPT
SEMESTER – III**

PTL 306 – PLASTICS TESTING LAB – I

(134 Hours)

S. No.	Name of Exercise	No. of Hrs.
1.	Identification of Plastics by Simple methods Primary Tests – Elemental Analysis – Confirmation Tests	<u>68</u>
2.	Determination of Density by Displacement Method	<u>7½</u>
3.	Determination of Melting Point	<u>6</u>
4.	Determination of Filler Content	<u>7½</u>
5.	Determination of Moisture Content	<u>3</u>
6.	Determination of Volatile Content	<u>3</u>
7.	Determination of Ash Content and Loss on Ignition	<u>6</u>
8.	Determination of Linear Shrinkage and Shrinkage on Transverse Direction	<u>6</u>
9.	Determination of Carbon Black Content and Dispersion	<u>7½</u>
10.	Determination of Rate of Burning	<u>6</u>
11.	Determination of Dilute Solution Viscosity	<u>6</u>
12.	Determination of K-value for PVC resin	<u>7½</u>

**DPT
SEMESTER – IV**

PT 401 – Fundamentals of Plastics Product And Mould Design (54 Hours)

Unit – I Product Design (13½ Hours)

Product Design Concepts – shape and size, function, aesthetics, life, tooling aspects on product design – process variables Vs product design - product design thumb rules for plastics - cost reduction through product design concepts - design of external, internal undercuts - side openings - hinges - assembly through resilience properties - case studies.

Unit – II Injection Mould Design (18 Hours)

Mould design concepts - Introduction - concept of design - design principles - parting line - mould elements - types of moulds - construction of core and cavities - position of gate - gate balancing – ejection - types of ejections - mould cooling - mould alignment - ancillary parts of the mould.

Types of Injection Moulds - Two plate mould - Direct Sprue injection - Single Impression - Multi Impression - Side Gated – Three Plate Moulds - Stack Moulds - Multi Day Light Moulds., Hot runner moulds

Split moulds - external undercut - internal undercut - delayed action - cam track actuation - hydraulic core pulling devices - split cavities - split cores - threaded inserts - internal and external.

Methodical approach to mould design - determination of economical number of cavities – mould standards bolsters - standard mould parts - mould design check list.

Unit – III Compression Mould Design (13½ Hours)

Types of compression moulds, open flash, semi-positive type, positive, displacement moulds, types of loading chambers, bulk factor, flash thickness, pot design, projected area, compression pressure, clamping force, no. of impression by technological method, heating system, types of heaters, heat loss, heat requirement & heater capacity.

Transfer Mould Design - Types of transfer moulds, integral pot transfer mould, auxiliary ram transfer mould, transfer pot design, projected area, transfer pressure, clamping force, pressure pad design, design of sprue runner and gate, advantages and disadvantages of transfer mould - design related calculations.

Unit – IV (9 Hours)

Blow Mould Design : Types of Blow Moulds - Extrusion - Injection and Stretch Blow Moulds - Blow Ratio - Parison Design - pinch off design - Parting Line - Clamping Force - Mould venting, Mould Cooling - Mould Alignment.

Extrusion Die Design -Principles of Extrusion - Die geometry - die swell - Die Land Design - Sizing die design - Construction of extrusion dies - blown film - pipe - profile - flat film - sheet - Wire Coating and Co-Extrusion Dies.

Design of other Moulds-Thermoforming-vacuum forming-rotational mould RIM moulds

Text / Reference Books

1. Technical Manual on Plastics Mould Design –
2. Injection Mould Design for Thermoplastics – Pye, R. G. W.
3. Plastics Product Design Engineering – Dubois H.
4. Runner design / Feed systems

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – IV**

PT 402 – PLASTICS PROCESSING TECHNOLOGY – II (54 Hours)

Unit – I Rotational Moulding (7½ Hours)

Basic principle - Material selection and Estimation through trial analysis - Type of machine - Process variables - Charge size - wall thickness control - Heating and Cooling system Process requirement for the moulding of water tank - Dust Bin etc. Application of Rotational Moulding - Ejection and Finishing – Fault - Causes and Remedies - Merits and Demerits of Rotational Moulding Process.

Unit – II Thermoforming (18 Hours)

Basic principles – Advantages - Material Selection - Thermoforming machine – Single Stage - Multi Stage - Sheet fed m/c - Packaging Machine - Mould Material - Thickness Control - Types of Forming – Vacuum Forming – Free Forming - Plug-assist-forming - Drape forming - Matched die forming - Drape forming - Snap back forming - Dual sheet forming - Skin & Blister pack forming - Types of heating - process variables - Forming of Disposal Cups & tumbler - Refrigerator Panel & Automobile Body – Faults - Causes & Remedies.

Unit – III Calendering (7½ Hours)

Process Description - Materials used - Advantages over extrusion - Types of Calender Rolls - Heating System - Roll Bending - Complete Description of Calendering line with their function – Heating & Cooling System - Winding Types and Method - Finishing – Trouble Shooting.

Unit – IV Fibre Reinforced Plastics (FRP) (10½ Hours)

Introduction - FRP processing methods - contact moulding - hand layup, spray up method - vacuum bag and pressure bag moulding, filament winding, centrifugal casting, pultrusion, matched die moulding.

Unit - V Secondary Processes (10½ Hours)

Powder coating, casting, machining, joining of plastics - Decoration of plastics - Metalizing - Printing & Painting etc - Post moulding operations, Assembly techniques, In mould labeling

Text / Reference Books

1. Compression Moulding – Iyesaw, A.I.
2. Technical Manual on Plastics Processing –
3. Plastics Engineering Hand Book – Society of Plastics Industry Inc.
4. Plastics Materials & Processing – Strong A Brent.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – IV**

PT 403 – PLASTICS TESTING – II (**40½** Hours)

Unit – I Electrical & Optical Properties (**15** Hours)

Dielectric strength - Dielectric constant and Dissipation factor - Insulation resistance - Volume and Surface resistivity - Arc resistance - Antistatic tests.

Refractive index - Luminous transmittance - Clarity and Haze - Photo-elastic properties - Colour measurements and Gloss.

Unit – II (**10½** Hours)

Chemical Properties

Introduction – Immersion test – Stain Resistance of Plastics – Environmental Stress Cracking Resistance (ESCR).

Flammability

Introduction – Flammability Test – Ignition Properties – Oxygen Index Test – Flammability of Cellular Plastics – Smoke Density Test – UL90 Flammability Test.

Unit – III (**7½** Hours)

Weathering Properties

Introduction – environmental factors affecting plastics – Accelerated weathering tests – outdoor weathering of plastics – Resistance of plastics to biological systems.

Bio-degradability Testing

Test methods and standards for bio-degradable plastics - Criteria used in evaluation of bio-degradable plastics - Description of current test methods.

Unit – IV (**7½** Hours)

Product Testing

Plastics Pipes – Films – Woven sacks – Water Tanks – Containers & Plastic Foams.

Text / Reference Books

1. Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K. Nayak
2. Plastics Testing Technology Hand Book – Shah Vishu

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – IV****PT 404 – POLYMER COMPOSITES AND APPLICATIONS (40½ Hours)****Unit – I Introduction to Composites (10½ Hours)**

Definition – Advantages – Raw Material – Matrix – Reinforcements – Properties of Polymer Matrix - Thermoplastics Materials such as Polypropylene, Nylon-6, 66, 610, 11 & 12 – Polybutylene Terephthalate (PBT) – Polycarbonate (PC) – Polyoxymethylene (POM) – Polyphenylene Sulphide (PPS) – Vinyl Plastics & Thermoset Plastics such as PF, UF, MF – Unsaturated Polyester Resin – Alkyd Resin – Epoxy Resin – Polyimide Resin – Polyurethane & Silicon.

Unit – II Reinforcements and additives (10½ Hours)

Fillers & Reinforcement for composites – Natural Fiber – Cellulose, Jute, Coir, Linen, Vegetable Fiber, Banana fibre properties and applications

Synthetic Fibers : Glass Fiber , Carbon Fiber , Aramide Fiber, Polymeric Fiber , Metallic Fiber Properties & Applications – Coupling Agents – Curing Agents – Lubricants – Plasticizer & Nano Filler.

Unit – III Composite Processing Methods (13½ Hours)

Composite Processing - Injection – Dough Moulding Compound, Bulk Moulding Compound, Sheet Moulding Compound – Open Mould Process – Hand Layup, Spray-up, Bag Moulding, Filament Winding – Closed Mould Process – Centrifugal Casting, Resin Injection, Continuous Process – High Pressure laminates – Pultrusion Process.

Unit – IV Applications of Composites (6 Hours)

Application of Composites in Aerospace – Automobiles – Building & Construction – Wind Power Generation – Electrical & Electronics – Defence – sports and medical

Text / Reference Books

1. FRP Manufacturing Process – Philip Ball.
2. Composite Polymeric Materials – Sheldon.
3. FRP Technology – Weathehead.
4. Advanced Polymer Composites – Borz Jang.
5. Technical Manual on Plastic Processing – .

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – IV**

PTL 405 – PLASTICS PROCESSING LAB – II**(162 Hours)**

Sl. No.	Name of M/c Equipment/ Mould	Description of practical exercise to be done*	Exercise Code No.	No. of Hours
1	Injection Moulding Semi Automatic	(i) Safety precautions to be taken in Shop floor (ii) Study of semi automatic Injection moulding machines of all types. Comparative study of Pneumatic type & Hydraulic type of machines operating principles of machines with nomenclature of parts, machines specifications. (iii) Operation of Pneumatic & Hydraulic type of Semi automatic Injection moulding machines, to produce components in different moulds. Cycle-time analysis, observations of process parameters & Procedure to be recorded.	PP-09	<u>27</u>
			PP-10	<u>20</u>
2	Extrusion Processes	(i) Study of extruders , Free sketch of machines, their parts and parts-function, List of products manufactured by Extrusion process. Study of different types of extrusion process. (ii) Procedure for setting up of process-parameters eg. Temperature on different zones, screw speed, Nip-roller speed, Winder speed, Blow ratio, Control of cooling-Air on bubble, Methodology & Practice by trainees to fix the Blown film die on M/c. Familiarization of Die-parts & their function, technical specification of machines, defects, causes & remedies, Practice of operating machine to produce different sizes of blown film. Study of the machine parts & function from screw drive to the caterpillar. Practice of Die setting on the machine, Procedure for setting up of parameters & operation practice in running the machine to produce Pipe/ tube/ Film.	PP-11	<u>20</u>
			PP-12	<u>27</u>
3	Compression & Transfer moulding- Semi auto & Automatic	Parameter setting, operation-practice on different Compression & Transfer Moulds, observation & procedure of startup & shut down of machine. Setting up procedure for operation of machine, Safety precautions, type of mould clamping arrangement available on Machine-Platen, Mould clamping procedure on machine, Operation of machine by setting the optimum temperature, curing time, clamping force, ejector-stroke etc. on continuous basis, Analysis of product defects & remedies, Analysis of cycle-time, Practice on operation of compression & Transfer moulds with thermoset materials.	PP-13	<u>27</u>
4	Blow-Moulding Semi Auto & Automatic	Technical specification of machine, Mould clamping on machines. Familiarisation with control-switches/valves on the machine, & procedure of operation of machine. Machine-setting Procedure, Parameter Setting Procedure, Method of mould fixing & Parison-die setting on machine, Practice by trainees to remove & fix Parison die to produce an appropriate Parison for blowing, type of blowing systems, operation-practice on different moulds, cycle-time analysis, process-faults & remedies.	PP-14	<u>27</u>
Two practical test on Plastic Processing Lab				<u>6 Hours per test</u>
VIVA-VOCE				<u>2 Hours</u>
Total hours				<u>162</u>

* Practical Exercises on operation of machines shall be done as per the operating-manual instruction of the respective M/cs.

*One test may be conducted in the middle of the Semester and the other one at the end of the Semester followed by Viva-Voce.

**DPT
SEMESTER – IV**

PTL 406 – PLASTICS TESTING LAB – II

(160 **108** Hours)

S. No.	Name of Exercise	No. of Hours
1.	Specimen Preparation by Injection Moulding	<u>08</u>
2.	Specimen Preparation by Compression Moulding	<u>08</u>
3.	Specimen Preparation by Cutting	<u>06</u>
4.	Specimen Preparation by Punching	
5.	Hot Roll Milling for Melt Mixing	<u>06</u>
6.	Determination of Tensile Properties	<u>08</u>
7.	Determination of Flexural Properties	<u>06</u>
8.	Determination of Compressive Properties	<u>06</u>
9.	Determination of Izod & Charpy Impact Strength	<u>08</u>
10.	Determination of Dart Impact Resistance of Plastic Films & Sheets	<u>06</u>
11.	Determination of Hardness (Shore – A & D, Rockwell Hardness, Barcol Hardness)	<u>06</u>
12.	Determination of Melt Flow Index	<u>08</u>
13.	Determination of Heat Distortion Temperature	<u>14</u>
14.	Determination of Vicat Softening Temperature	
15.	Determination of Rate of Burning	<u>06</u>
16.	Determination of Limiting Oxygen Index	
17.	Determination of Volume Resistivity & Surface Resistivity	<u>06</u>
18.	Determination of Arc Resistance	
19.	Determination of Dielectric Strength	
20.	Determination of Clarity & Haze	<u>06</u>

**DPT
SEMESTER – IV**

PTL 407 – CAD LAB

(54 Hours)

S. No.	Name of the Exercise	No. of Hours
1.	Hand Injection Mould Design	<u>2½</u>
2.	Design of Mould Elements / Standard Mould Base	<u>06</u>
3.	Single Impression Two Plate Mould	<u>06</u>
4.	Multi-impession Two Plate Mould	<u>06</u>
5.	Three Plate Mould (Multi-impession)	<u>10½</u>
6.	Split Mould Design	<u>10½</u>
7.	Mould Design for Internal Undercuts	<u>10½</u>
8.	Mid Term Test	<u>2</u>
	Total	<u>54</u>

**DPT
SEMESTER – V**

PT 501 – ADVANCED PLASTICS PROCESSING

(54 Hours)

Unit – I Specialized Injection Moulding Process

(19½ Hours)

Advanced Microprocessor Controlled Machines - Merits & Demerits - Co-Injection Moulding - Two Colour Injection Moulding - Gas Assisted Moulding - Water Assisted Moulding - Reaction Injection Moulding - Liquid Injection Moulding – Lost Core Moulding – Structural Foam Moulding – Low Pressure foam - high pressure foam – Sandwich Moulding – Thin Wall Product Moulding

All Electric Injection Moulding Machines - Tie bar less Injection Moulding, Automated Conveyor system, Automatic Material loading

Unit – II Advanced Blow Moulding Process

(15 Hours)

Classification of Advanced Blow Moulding Processes - Stretch Blow Moulding – Preforms – Extrusion Stretch Blow Moulding – Injection Stretch Blow Moulding – Principles and Operation – Forced Extrusion - Accumulator Blow Moulding - Double Wall Blow Moulding - Multi-layer Blow Moulding.

Unit – III Advanced Extrusion Process

(13½ Hours)

Profile Extrusion - Material - Process - Process optimization - Downstream equipments - Dies and applications.

Multi-layer films, co-extruded sheets, Pipes, Corrugated pipes.

Unit - IV: Textile processing

(6 Hours)

Polymer processing for textiles, needle punching, melt blow , fibre spinning

Text / Reference Books

1. Technical Manual on Plastics Processing – .
2. Plastics Engineering Hand Book – Society of Plastics Industry Inc.
3. Introduction to Nano Technology – Charles P., Poor Jr. & Frank J. O.
4. Total Quality Process Control for Injection Molding, 2nd Edition, M. Joseph Gordon, Jr.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – V**

PT 502 – MAINTENANCE OF PLASTICS PROCESSING & TESTING EQUIPMENTS
(**40½ Hours**)

Unit – I (6 Hours)
Introduction to Maintenance

Importance and Objectives of Maintenance, Preventive Maintenance, Breakdown Maintenance, Predictive Maintenance, Schedule Maintenance, Maintenance Planning, Factors to be considered for Installation / Erection and Commissioning of Plastics Processing & Testing Machinery, General Method of Alignments and Leveling, Study of safety rules and regulations

Unit – II (13½ Hours)
Electrical

Repair and maintenance of the electrical equipments – Electrical induction motors (slip ring motors and squirrel cage motors), Variable Speed Motors, their characteristics and speed control.

Maintenance of Starter, Circuit Breakers (Air Circuit Breakers and Miniature Circuit Breakers)

Limit Switches & Timers, Relays, Temperature Controllers, and Thermocouples, Heaters (mica and ceramic type)

Unit – III (7½ Hours)
Mechanical

Screw, Barrel, Parts of Screw & Barrel clearance between screw and barrel, Non return valve, Thrust Bearing Unit, Gear Boxes, Calendar roll, Mill roll – platens flatness measurements, Platen parallelism measurement , Moving parts maintenance

Unit IV (13½ Hours)
Hydraulics

Pumps – Gear pump, Piston Pump, Radial / Axial Pump and Screw Pump – Valves, Valve sequences, Valve counter balance, Break valve, Pressure Reducing Valve , Relief Valve, Throttle Valve – Solenoid Valves, Hydraulic Motors, Hydraulic Actuators, Filters, Compressors, Oil seals, O - Rings - Central Lubrication System , Oil quality monitoring, filtration – Transmission system i.e. Gears, V-belts, Chains - PLC system used in plastics processing & Testing Machineries.

Text / Reference Book

1. Manuals on Hydraulics & Pneumatics – Vickers.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – V**

PT 503 - MOULD MANUFACTURING**(54 Hours)****Unit – I****(9 Hours)****Material for Moulds**

Mould Steel Requirement – Characteristics – Alloying Elements – Material Selection for Different Parts of the Mould – Non Ferrous Materials – Aluminum - Copper – Bronze – Beryllium Copper – heat treatment and its significance in Mould manufacturing.

Unit – II**(9 Hours)****Mould Making Techniques - Conventional methods**

Introduction of mould parts and manufacturing, Different types of machines used, Cutting Tools - Tool Materials. Study of various machining operations -Turning, Shaping, Planning, Drilling, Grinding (Surface, Cylindrical), Milling (Horizontal / Vertical). Manufacturing of various mould elements.

Unit – III**(15 Hours)****Mould Making Techniques - Special Machine Tools**

Introduction to Special Machine Tools - Jig Boring Machine, Pentagraph, Electrical Discharge Machining (EDM) – Working Principle – Cutting Tools used in Mould manufacturing and maintenance. , wire cut and applications

Introduction of CNC Machines - Types - Application of CNC machines for mould making and maintenance.

Unit - IV**(13½ Hours)****Mould Polishing & Assembly**

Polishing Technology in Mold Making - Definition of Surface Roughness, Basics of Polishing Technology, Effect of Mold Materials on Polishability, Types of Polishing Tools, Methods of Polishing - Basic Information on Ultra Sonic Polishing – Principles of Electro Deposition in Damaged Molding Surfaces / Protective Coating.

Mould Assembly - Check list for Mould Assembly - Fitting and Assembly of various Mould Elements- Core Insert, Cavity Insert, Sprue Bush - Ejection System Assembly - Blue Matching and Die Spotting-Venting - Final Inspection - Fitting of Locating Ring and carrier bar.

Unit – V**(7½ Hours)****Mould Maintenance**

Mould Maintenance – Purpose – Scope – Responsibility - Aspects of Upkeep and Maintenance of Moulds - Specification sheets - History sheets - Instruction Manual- Factors for Physical Mould Life - Maintenance Frequency - Break Down Maintenance - Suggested Tools available for proper tool maintenance - Maintenance list - Preventive maintenance - Mould Removing, Cleaning and Storage.

Text / Reference Books

1. Mould Making Hand Book, Stoeckert.
2. Plastics Moulds and Dies, Sors.
3. Injection Moulds, V.D.I.
4. Injection Mould Design –Pye R.G.W.
5. Production Technology - Er.R.K. Jain.
6. Production Technology - P.C. Sharma Pub: S. Chand and Co.
7. Workshop Technology, Volume I & II – W.A.J Chapman.
8. Elements of Workshop Technology-S.K.Hajra Choudhury & A.K Hajra Choudhury.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – V**

PTL 504 – PLASTICS PROCESSING LAB – III

(202.5 Hours)

Sl. No.	Name of M/c/ Equipment/ Mould	Description of practical exercise to be done*	Exercise Code No.	No. of Hours	Remarks
1.	Automatic Injection Moulding Machine	Safety Precautions to be taken while handling Machine, Mould & Tools on shop floor Idle-Run Observation (IRO) & study of injection unit, Clamping unit, Process control knobs, safety precautions, start-up procedure, shut-down procedure, sketch of machine platens, Clamping system, type of nozzle used in machine etc., study of hydraulic system used in the machine. Machines operation-Practice, Process parameter setting for a particular mould on the machine, Operation of Machine in Hand, Semi automatic and automatic-mode to produce components, observations of all parameters, cycle-time analysis, use of different plastics materials for moulding & comparison, moulding faults analysis for causes and remedies.	PP-14	<u>66.5</u>	
2.	Thermoformig (Vacuum Forming, Pressure Forming)	Study of process principle, type of moulds & material used, Mounting & Clamping of plastic sheet, heating & vacuum system, cooling, trimming and finishing. Familiarization with the machine controls for operation, Operation practice by trainee, observation on Cycle-time, processing-defects & remedies.	PP-18	<u>13½</u>	
3.	Rotational Moulding	Machine study in IRO, Process Principle & sequence of operation, Raw materials used & loading, Machine type, mould clamping practice on the machine, operation practice to produce roto moulded components, heating & cooling method adopted, Cycle-time analysis, Comparison of process with blow moulding & other processes.	PP-19	<u>22.5</u>	
4.	Plastics-Coating. Sealing, Welding, Screen-Printing, Solvent cementing & mechanical joining.	Principle of coating process, coating equipments, type of coating, type of material used, sequence of operation in coating. Principle of operation of Heat-sealing equipments, bag sealing, High frequency & hot gas welding & Hot stamping operation with specific reference to pipe. Familiarization of screen printing process, methodology for screen preparation, type of inks used. Joining of PVC pipes and fitting with solvent cement, Mechanical joining of plastic parts by bolting, inserts, threading etc.	PP-20	<u>22.5</u>	
5.	Study of Mould & its maintenance	Study of different types of moulds & Dies-injection , blow & compression moulds, Mould maintenance & storage	PP-21	<u>27</u>	
6.	FRP Process	Study of types of resins, Fibres & additives used in the process, material selection & equipment requirement. Sequence of process operation in Hand lay-up process, Operation practice for hand lay-up process for producing FRP products like helmet, trays, plate, chairs etc. mould material & making, curing, part ejection & finishing. Precautions during the Process-defects & analysis for the remedies	PP-22	<u>27</u>	

7.	Study of ancillary Equipments	Hopper Dryer, Chiller, Mould Temperature Controller, Cooling Tower, Mixer	PP-23	<u>13½</u>	
			Two practical test on Plastic Processing Lab	<u>4 Hours Per Test</u>	
			VIVA-VOCE	<u>2 Hours</u>	
			Total Hours	<u>202.5</u>	

*Practical exercises on operation of machines shall be done as per the operating manual instruction of the respective M/cs.

**The exercise shall be done in Tool Room Department.

*One test may be conducted in the middle of the Semester and the other one at the end of the Semester followed by Viva-Voce.

**DPT
SEMESTER – V**

PTL 505 – PLASTICS TESTING LAB – III

(**162** hours)

Product Testing as per BIS Standards

S. No.	Name of Exercise	No. of Hours
1.	Testing of PVC Pipes and Fittings	<u>16</u>
2.	Testing of HDPE Pipes and Fittings	<u>16</u>
3.	Testing of LDPE Films	<u>16</u>
4.	Testing of PET Containers for Drinking Water	<u>14</u>
5.	Testing of PP and PC Feeding Bottle	<u>14</u>
6.	Testing of Water Storage Tank	<u>14</u>
7.	Testing of Foam	<u>14</u>
8.	Testing of FRP Products	<u>14</u>
9.	Testing of Irrigation Laterals & Drippers	<u>16</u>
10.	Testing of Woven Sacks	<u>14</u>
11.	Migration Test to Stimulants	<u>4</u>
12.	Testing of Vinyl Flooring	<u>10</u>

**DPT
SEMESTER – VI**

PT-601 Plastics Recycling and Waste Management (**40½** Hours)

UNIT – I Plastics Wastes and its Separation (**9** Hours)

Introduction – Sources of Plastics Waste – Collection of Plastics Waste – Sorting and segregation methods viz. simple identification techniques, Density Separation, Solvent Separation, floatation technique, Air classification, Melt filtration and Equipment based sorting techniques.

UNIT – II Plastics Waste Management Techniques (**15** Hours)

Plastics Recycling – 4 R & I approach – code of Practice – types of Recycling viz. Primary, Secondary, Tertiary and quaternary techniques with examples – Fuel from Plastics Waste - Energy recovery from Plastic Waste – Co-processing in cement kiln – Plastic Waste in Road Construction.

UNIT – III Machinery and Value addition (**10½** Hours)

Process flow chart by mechanical route - Basic Mechanical recycling Plant – Additives for improving quality of recycled products – value addition in Plastics recycling viz., PP/HDPE woven sacks to Pots, PE/PE multilayer film waste to moulded products.

UNIT – IV Plastics Waste and Environment (**6** Hours)

Environmental issues and Guidelines for Recycling of Plastics Wastes – Environmental legislation in India.

Text / Reference Books

1. Technical Manual on Plastics Processing –
2. Recycling & Plastics Waste Management – Dr. J S Anand
3. Environmental Engineering & Management – Suresh k. Dameja

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – VI**

PT 602 – INDUSTRIAL MANAGEMENT AND COSTING (40½ Hours)

Unit – I (10½ Hours)

Principles of Management: Introduction - Management as an art of getting things done, Management as a process, Management as an activity, Management and administration – Development of management theory: - Taylor’s Scientific Management.

Functions of Management: Planning, Organizing, Staffing, Directing, Controlling, Decision making.

Organizational Structure: Definition of organization, different types of organizational structure: - Line Function, Line & Staff Organization (brief description with advantages & disadvantages), Leadership, Motivation and Communication.

Human Resource Management: Concept of HR Management – Development of HR Management – Components of HRD – Job Analysis – Job Description – Job Specialization , Manpower Planning – Requirements of Manpower Planning – Factors Affecting the Manpower Planning – Job Evaluation – Steps Required for Job Evaluation – Methods for Job Evaluation – Merit Rating – Objectives and Methods – Performance Appraisal. Training – Importance of Training – Methods of Training – Advantages of Training

Unit – II (9 Hours)

Quality Planning and Control: Definitions of Quality, Requirements of Quality, Objectives of Quality Planning – Quality Control: - Operator’s Quality, Inspectors Quality Control, Mangers Quality Control, Total Quality Control.

Quality Assurance: - Concept, Definition, Responsibility of Quality Assurance, Planning for Quality Assurance

ISO 9000 & Implementation: Concept and role of ISO 9000, what is ISO 9000, whom does it help, elements of ISO 9000, steps for implementation of quality system - preparatory step, implementation step, registration & certification step. Quality Audit - objectives, types off audits, Benefits of becoming an ISO 9000 company.

Concept of TQM and Organizational Excellence: Concept, ten mantras of TQM, the link between ISO 9000 and TQM with the help of TQM Model – organization of TQM. Techniques of TQM - PDCA, Total Employee Involvement (TEI), POKA –YOKE – Failure proofing, JIT manufacturing. Quality Circles - concept, characteristics, Brain storming method for solving Q.C. Problems.

Unit – III (10½ Hours)

Behavioural Science

Introduction – Behavioural Science – Organization Behavior – Individual Behavior. Personality – Self Concept, Self Esteem & Self Efficacy – Immaturity to maturity, Socialization Process – perception.

Attitudes – Nature and Dimension of Attitude, Components of Attitude, Function and Changing Attitude, Organization Commitments & Winning Attitude – Values & Business Ethics.

Motivation Meaning – Need for Motivation – Theories of Motivation – Nature of Motivation. Group Behavior – Organizational Conflict, Job Satisfaction, Job Stress – Group Dynamics, Inter Personnel Dynamics.

Industry – Entrepreneurship

Steps required to start small scale industry, procedure for registration (provisional and permanent registration) – sources of financial assistance, govt., assistance for development of SSI, preparation of project report, Tax: - an overview of income tax – excise duty, sales tax – procedure to be followed for sales tax.

Unit – IV

(10½ Hours)

Costing

Basic Principle of Costing – Direct Cost – Indirect Cost – Labour Costing – Stores Organization – Factory Overhead Costs – Costing Methods.

Standard and Marginal Costing – Break – Even Point Control Functions – Cost Reduction – Value Analysis – Cost Audit – Costing as related to mould and mouldings.

Profoma for Cost Estimation – Product Cost – Mould Cost – Processing Cost – Project Costing – Direct Cost – Indirect Cost – Break Even Point.

Text / Reference Books

1. Industrial Engineering Management – Khanna O. P.
2. Cost Accounting Principles & Practice – Nigamlal & Jain J. C.
3. Personal Management & Industrial Relations – Davar R. S.

Note: Minimum of one assignment is mandatory from each unit.

**DPT
SEMESTER – VI**

PTL 603 – MAINTENANCE OF PLASTICS PROCESSING AND TESTING MACHINERY (81 Hours)

List of Practicals

1. Installation and Commissioning of Plastics Processing & Testing Machines.
2. To check the alignment and moving parts of various machinery like extrusion, injection moulding machine and blow moulding machine, UTM machine.
3. Repair and Maintenance of Hydraulic System in machines such as Injection Moulding, Blow Moulding Machines, Two Roll Mill, Compression Moulding Machine.
4. Positive and hydraulic actuators and motors.
5. Lubrication System, Central Lubrication System, O-rings, Oil Seals.
6. To carry out breakdown maintenance of electrical equipments like induction motors, variable speed motors, circuit breakers used in plastics processing & testing machinery.
7. Study of temperature control with thermocouples and timer (Digital & Analogue)
8. Transmission systems (Transmission and distribution of power system)
9. Study of AC/DC motors.
10. Study of D.O.L starters.
11. Study of Star-delta starter used in Injection Moulding M/c.
12. Study of PLC in processing & testing machines.
13. To carry out the preventive maintenance of machines like injection moulding machine, blow moulding machine, extruder, Microprocessor based injection moulding machine – Preparing maintenance charts for periodical inspection.
14. Repair and maintenance of various pumps.
15. Trouble shooting of various M/c and their remedies.

**DPT
SEMESTER – VI****PTL 604 – PROJECT WORK****(351 Hours)****Project Work**

Project work aims at developing skills in the students where they can apply the totality of knowledge and skills gained through the course curriculum to find out a solution to the particular problem or to undertake a project. The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group activity. Preferably there should not be more than 3 students in a group. The students should identify or given a project assignment at least two to three months in advance. The project work shall be identified in collaboration with industry may be preferred.

Each faculty member is expected to guide the project work of 5 – 6 students.

- Projects related to increasing productivity.
- Projects related to quality assurance.
- Projects related to estimation and economics of production.
- Projects connected with repair and maintenance of plant and equipment.
- Projects related to identification of raw material thereby reducing the wastage.
- Projects related to suggesting substitutes of the polymer being used.
- Any other related problems of interest of host industry.
- Industry project
