

**POST DIPLOMA
IN
PLASTICS MOULD DESIGN WITH CAD/CAM
(PD-PMD WITH CAD/CAM)**

SYLLABUS & CURRICULUM

2014

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



Academic Cell

**Central Institute of Plastics Engineering &
Technology**

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POST DIPLOMA IN PLASTICS MOULD DESIGN WITH CAD/CAM

(PD-PMD WITH CAD/CAM)

SYLLABUS

SEMESTER - I

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PD 101	Plastics Materials	<u>36½</u>	<u>4</u>	3	40	60	100
PD 102	Plastics Product Design	<u>51</u>	<u>3</u>	3	40	60	100
PD 103	Plastics Mould Design – I	<u>51</u>	<u>3</u>	3	40	60	100
PD 104	Plastics Processing Technology	<u>36½</u>	<u>4</u>	3	40	60	100
Total <u>(18 weeks – 10½ hours per week)</u>		<u>174</u>	<u>15</u>	12	160	240	400
		<u>189</u>					
PRACTICAL							
PDL 105	Plastics Testing & QC Lab	<u>27</u>		4	50	50	100
PDL 106	Plastics Processing Lab	<u>27</u>		4	50	50	100
PDL 107	Design Lab – I	<u>270</u>		8	200	200	400
	Library	<u>27</u>		-	-	-	-
Total <u>(18 weeks – 19½ hours per week)</u>		<u>351</u>		16	300	300	600

SEMESTER - II

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
PD 201	Plastics Mould Design – II	<u>51</u>	<u>3</u>	3	40	60	100
PD 202	Mould Manufacturing Technology	<u>24</u>	<u>3</u>	3	40	60	100
PD 203	Reverse Engineering And Rapid Prototyping	<u>24</u>	<u>3</u>	3	40	60	100
PD 204	Process Planning & Cost Estimation	<u>24</u>	<u>3</u>	3	40	60	100
Total <u>(18 weeks – 7½ hours per week)</u>		<u>123</u>	<u>12</u>	12	160	240	400
		<u>135</u>					
PRACTICAL							
PDL 205	Manufacturing Practice	<u>108</u>		8	100	100	200
PDL 206	Design Lab - II	<u>270</u>		8	200	200	400
	Library	<u>27</u>		-	-	-	-
Total <u>(18 weeks – 22½ hours per week)</u>		<u>405</u>		16	300	300	600

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

POST DIPLOMA IN PLASTICS MOULD DESIGN WITH CAD/CAM
(PD-PMD WITH CAD/CAM)

SYLLABUS

SEMESTER - III

CODE	SUBJECT	HOURS			MARKS		
					INT	EXT	TOTAL
PDL 301	Project Work	<u>378</u>			200	200	400
PDL 302	In plant training in industry **	<u>54</u>	-	-	100		100
PDL 303	Seminar – 20 weeks 4 hrs a week	<u>54</u>			100		100
	Library – 20 weeks 4 hrs a week	<u>54</u>	-	-	-		-
	Total	<u>540</u>					600

0CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

Note:

** - Industrial Training should be of two weeks duration during the semester.

- Training Report from the Industry needs to be submitted.

**PD-PMD With CAD/CAM
SEMESTER – I**

PD 101 - PLASTICS MATERIALS**(40½ Hours)****UNIT I Polymers****(6 Hours)**

Introduction to polymers, Natural polymers – Polymerization – types of polymerization techniques. Types of plastics – thermoplastic & Thermoset – Amorphous & crystalline polymer. Introduction to thermal, mechanical, electrical, chemical & optical properties.

UNIT II Commodity Plastics**(7½ Hours)**

General properties and application of Polyethylene - Polypropylene and their co-polymers - Vinyl Polymers and Co-polymers - Polystyrene and Copolymers - Acrylic and copolymers - Cellulose Polymers. Manufacturers & availability of various grades.

UNIT III Engineering Plastics**(7½ Hours)**

General Properties and application of Acrylonitrile Butadiene Styrene - Polyamides(PA-6, PA-6,6 & PA-11) - Polycarbonates - Polyacetal & Copolymers - Thermoplastic Polyesters (PET & PBT)-Polyphenylene oxide – Polysulfones - Fluoro polymers (PVF, PVDF, PTFE, PCTFE) - Thermoplastic Polyurethane. Manufacturers & availability of various grades.

UNIT IV Specialty Plastics**(12 Hours)**

General properties and applications of Polyphenylene Sulphide - Polyphenylene ether- Polyether ether ketone-Polyimide and related polymers- Liquid Crystal Polymers- Conductive Polymers- Plastic alloys and blends. Manufacturers & availability of various grades.

Polymer composites, Blends & Alloys: Definition, Properties, Advantages & Applications.

UNIT V Thermosetting Plastics**(7½ Hours)**

agents - General properties and applications of Additives - Curing and cross linking Phenol Formaldehyde - Urea Formaldehyde - Melamine Formaldehyde - Unsaturated Polyesters - Epoxy resins - Polyurethane and Silicones. Manufacturers & availability of various grades.

Text / Reference Books

1. Hand Book of Plastic Materials & Technology, Rubin Irwin J
2. Plastics Materials, Brydson, J.A
3. Plastics Materials & Processes , Schwartz & Goodman
4. Text book of Polymer Science, Fred W Billmeyer
5. Polymer Science V.R. Gowariker
6. Principles Polymer Science P.Bahaabur& N.V. Sastry,Narosa Publishing House

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

**PD-PMD With CAD/CAM
SEMESTER – I**

PD 102 - PLASTICS PRODUCT DESIGN (54 Hours)

UNIT I Product Design Requirement (12 Hours)

Concept to commercial products – Product specification – Material selection – Process selection – Design for Manufacture & Assembly (DFMA). Tooling Aspects on Product Design – Product Design Appraisal. Geometric Dimensioning and Tolerances on Product.

Product design criteria – Structural, Environmental, Assembly, Aesthetics & Decoration. Product design check list, Good design practices, Safety in product design.

UNIT II Product Design Features (21 Hours)

Shrinkage, Wall thickness – variations in wall thickness – suggested wall thickness for various plastics materials – Tapers or draft angles. – Design of radii, fillets, ribs and bosses. Undercuts – External & Internal –. Moulded Holes - through holes – blind holes – threaded holes – side holes – holes parallel to draw – nearness of holes to each other and side wall – moulding holes not parallel to draw – drilled and tapped holes.

Design of integral hinges, hinges and snap fits for boxes and assembly of moulded parts. Moulded threads – thread types. Interference between the threads. Inserts – materials – selection of metal for inserts – minimum wall thickness of material around inserts – anchorage - relieving moulding stresses around inserts – location of inserts in the part – moulded inserts – pressed in inserts.

UNIT III Design of Structural Elements (10½ Hours)

Tension bars – columns – beams – pipes – plates and shells. Design of joints – bolted joints – bonded joints, etc.

Designing with plastics for load bearing applications like gears, bearing, spring. Assembly – Mechanical fasteners

UNIT IV Composite Product Design (10½ Hours)

Concepts of composite product design – Design requirements – functional – safety – reliability – cost effectiveness.

Design constraints – factor of safety for uncertainties in design – design failure criteria – optimization in design.

Design data – physical, mechanical and functional properties of composites – code of practice of loading on structures – structure and property relation of composites.

Text / Reference Books

1. Plastics Product Design, Beck
2. Plastic part design hand book, Rosato
3. The complete part design hand book (Injection Mould of Thermo Plastics), E. Alfredocampo

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

**PD-PMD With CAD/CAM
SEMESTER – I**

PD 103 - PLASTICS MOULD DESIGN – I

(54 Hours)

UNIT I Mould Design Fundamentals

(16½ Hours)

Introduction: Basic construction of mould – Types of moulds – Mould parts – mould plates, sprue bush, locating ring, core and cavity, Guide pillar & guide bush, Bolsters, Types of Bolsters, Mould clamping methods, Mould lifting arrangements

Feed System: Sprue, Runner & Gate – cross section and size of runner –runner layout – balancing of runners – types of gates for various materials – cross section of gate – gate balancing. Empirical formulae

Parting Surface: Parting line/Parting surface: Flat parting surface – Non flat parting surface – stepped parting surface, irregular parting surface, angled surface, local stepped and profile parting surface, complex edge forms –Mould Venting.

UNIT II

(12 Hours)

Ejection System:

Types of ejector grid – Ejector plate assembly – Guiding & Supporting ejector plate assembly - Types of ejection – position & critical area of ejection – pin ejection – stepped pin-part of pin-“D” – Pin-blade ejection – sleeve ejection – stripper ring ejection – stripper plate ejection – air ejection – double ejection – Delayed action ejection – Types of sprue pullers – calculation of support pillar requirements. Calculation of Ejection force, ejection stroke etc.

Mould Temperature Control System:

Mould cooling – Integer type cavity and core plates cooling, angled hole systems, baffled hole systems, stepped circuit – Types of bolster cooling – Insert cooling, Deep chamber design, Bubbler cooling, Baffle cooling, spiral cooling –cooling circuits – Principle of heat pipe, heat rod, capillary tube and its applications – Cooling for sprue bush – O-rings – cooling nipples – Calculation of cooling efficiency, cooling time. Mould heating methods, Mould temperature controller.

UNIT III Types of Injection Moulds

(13½ Hours)

Two Plate / Part Mould and Three Plate / Part Mould Design, Split moulds: External undercuts - Splits – Guiding and retention of splits – finger cam and dog leg cam actions – cam track – spring – hydraulic actuation – side cores and side cavities – Calculation of split movement – Split safety arrangements –Angled lift split – form pin and Angled pin action – split cores– Collapsible core.

UNIT IV Selection of Machines

(6 Hours)

Types of injection moulding machines – specifications – shot capacity – shot weight – plasticising capacity – projected area – locking forces – platen details – maximum and minimum daylight – nozzle details – locating mould on machines– ejection systems – Machine platen locking methods – dry cycle time and its application in Mould Design. Calculating No. of impressions –projected area, injection pressure, clamping tonnage. Lay-out of impressions.

UNIT V Standard Mould Parts

(6 Hours)

Standard Mould Base- Advantages and limitations, manufacturers etc., Standard ejector pins, guide pins, bushes, mould date indicators, mould springs, cooling baffles, nipples, parting locks etc

Text / Reference Books

1. Injection Mould Design – Pye R.G.W
2. Injection Moulds 130 Proven Design Gastrow

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

**PD-PMD With CAD/CAM
SEMESTER – I**

PD 104 - PLASTICS PROCESSING TECHNOLOGY**(40½ hours)****UNIT I Injection Molding****(10½ hours)**

Introduction - process variables - moulding cycle - cylinder temperatures - shear and orientation - runner systems - balancing of impressions - injection nozzles - insulated nozzles - hot runner moulds - insulated runner moulds - semi automatic and automatic moulds - operation and maintenance.

Types of injection moulding machines - machine specifications - projected area - plasticizing capacity - shot weight - type of locking systems - mould clamping - hydraulics - basic principles - hydraulics - hydraulic control - oil requirements - routine maintenance - safety rules.

Mould setting – effect variables on mouldings - shrinkage - quality control aspects - faults - causes and remedies.

UNIT II**(10½ hours)****Blow Moulding:**

Introduction to blow moulding - types of blow moulding operations - extrusion blow moulding - injection blow moulding - stretch blow moulding - basic principles - parison control - wall thickness in relation to parison - types of extruders for blow moulding - blow mould construction - setting and operation - mould cooling - clamping force - cycle time - moulding faults - causes and remedies - quality control - operator safety.

Extrusion:

Introduction - extruder parts - extrusion screw - design features - design variables - extruder output - extrusion process parameters - their effects on product - extruder faults - causes and remedies. Extrusion of film, pipe, sheet, profile and coating - dies for different extrusion process - sizing units - hauloff units - process control systems - process variables - quality control and safety.

UNIT III**(6 hours)****Compression & Transfer Moulding:**

Compression moulding - fundamental principles - bulk factor - flow properties - processing temperatures - mould temperature control - moulding pressure - press tonnage - limitations - curing time - influence of processing parameters on the quality of the moulding - moulding conditions - raw material quantity (charge size) - by volume/weight - pelleting - preheating the pellets - simple test for rate of cure - defects - causes and remedies of the common moulding faults - operator safety and routine quality control.

UNIT IV**(9 hours)****Thermoforming:**

Introduction - thermoforming methods - thermoforming dies - thermoforming equipment description - temperature control - cycle time - defects, causes and remedies - quality control and safety

Roto-Moulding:

Introduction to rotomoulding – principle of bi-axial rotation – equipment description – temperature control systems – cycle time – defects, causes and remedies.

Post Moulding Operations:

Printing and decoration of moulded items - films - pipes - sheets, etc. - hot stamping - pad printing - screen printing – rotogravure printing - heating ceiling - ultrasonic welding - adhesive bonding - fastening with metal inserts - limitations of post moulding operations - their advantages

UNIT V**(4½ hours)****Advanced Processing Techniques:**

Reaction injection moulding - principles - machine description - process control - cycle time - defects, causes and remedies - quality control and safety. Twin screw injection moulding machine, Twin barrel Injection moulding machine.

Structural foam moulding - principles - process description - process control - defects and remedies - quality control.

Resin transfer moulding - principles - process description - process control - defects and remedies - quality control.

Text / Reference Books

1. Hand Book of Plastic Materials & Technology, Rubin Irwin J
2. Plastics Materials, Brydson, J.A
3. Plastics Materials & Processes, Schwartz & Goodman
4. Plastics Processing, Beadle

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

**PD-PMD With CAD/CAM
SEMESTER – I****PDL 105- PLASTICS TESTING & QC LAB****(27 hours)****Practical Exercises**

1. Chemical Lab **2 Hours**
2. Specimen Preparation Lab **2 Hours**
3. Thermal Lab **6 Hours**
4. Mechanical Lab **6 Hours**
5. Electrical & Optical Lab **2 Hours**
6. Product Testing Lab **3 Hours**
7. Rheological Lab **3 Hours**
8. Characterization Lab **3 Hours**

**PD-PMD With CAD/CAM
SEMESTER – I****PDL 106 - PLASTICS PROCESSING LAB****(27 hours)****Practical Exercises**

1. Injection moulding machines : **10 Hours**
 - a) Hand operated
 - b) Semi-automatic & automatic
 - c) Microprocessor controlled automatic injection moulding process
2. Blow moulding machines: **2 Hours**
Hand operated, semi & automatic machines
3. Compression & transfer moulding machines: **2 Hours**
Hand operated, semi & automatic
4. Extrusion : **9 Hours**
 - a) Pipe & profile extrusion
 - b) Blown film extrusion
 - c) Multilayer blown film extrusion
5. Rotomoulding machines **1 Hours**
6. Thermoforming machines **1 Hours**
7. Fibre reinforced plastics processing **2 Hours**

**PD-PMD With CAD/CAM
SEMESTER – I**

PDL 107 - DESIGN LAB - I

(270 Hours)

(To be conducted in CAD/CAM Lab)

- | | | |
|-----|-----------------------------------------------------------------------|-----------------|
| 1. | Introduction and Practice on 2D drafting on CAD software | <u>27</u> Hours |
| 2. | Introduction and practice on 3D Modeling using Creo/UG/CATIA software | <u>50</u> Hours |
| 3. | Design of standard Mould Base | <u>14</u> Hours |
| 4. | Design of Hand Injection mold for single impression | <u>8</u> Hours |
| 5. | Design of Single impression two plate Injection Mould | <u>21</u> Hours |
| 6. | Design of Multi impression two plate Injection Mould | <u>27</u> Hours |
| 7. | Study & detail for the Exercise No. 5/ 6 | <u>21</u> Hours |
| 8. | Design of Three Plate Injection Mould (multi impression) | <u>27</u> Hours |
| 9. | Design of Split Injection Mould - without delayed action | <u>27</u> Hours |
| 10. | Design of Split Injection Mould - with delayed action | <u>27</u> Hours |
| 11. | Design of Injection Mould for internal undercut components | <u>21</u> Hours |

Note : Design Practicals Sl.No.:3 to 10 shall be carried out by utilizing CAD software.

**PD-PMD With CAD/CAM
SEMESTER – II**

PD 201 PLASTICS MOULD DESIGN – II (54 Hours)

UNIT I Advance Injection Mould Design (22 Hours)

Moulds for threaded components – automatic unscrewing – various unscrewing methods – inline layout – pitch circle layout – mould movements – hydraulic and pneumatic core systems for mould movement – runner less moulds – insulated and hot runner moulds – Types of manifold block, primary nozzle & secondary nozzle design – flow way system – types of shut off valve system – Hot runner mould – Water Assisted & Gas Assisted Injection Mould – multi-colour moulding – insert moulding – outsert moulding – stack mould – two and three level.

UNIT II Compression & Transfer Mould Design (14 Hours)

Compression Mould Design:

Types of compression moulds, open flash, semi-positive, positive, displacement moulds, types of loading chambers, bulk factor, flash thickness, 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 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 III Blow Mould Design (6 Hours)

Types of blow moulds - extrusion - injection stretch blow moulds - blow ratio - parison design - pinch off design - parting line - clamping force - mould venting, mould cooling - mould alignment. Design for industrial applications.

UNIT IV Extrusion Die Design (6 Hours)

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.

UNIT V Rotational Mould Design (6 Hours)

Introduction – Mould material – Mould design: Mould frame, Moulded in inserts, Moulded handles, Movable cores. – Mould venting – Mould cooling.

Text / Reference Books

1. Plastics Product Design Beck, R
2. Injection Mould Design – Pye R.G.W
3. Injection Moulds 130 Proven Design Gastrow

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

**PD-PMD With CAD/CAM
SEMESTER – II**

PD 202 - MOULD MANUFACTURING TECHNOLOGY (27 hours)

Unit I Material for Mould Making (7½ Hours)

Ferrous - non ferrous materials - copper - bronze - beryllium copper, Al - Mg alloys and its significance as a materials for mould making - miscellaneous materials - mould steel - alloying elements - material selection for different parts of the mould and their heat treatment, IS standards, British standards for mould materials.

Unit II Machinery for Mould Manufacture (7½ Hours)

Tool room machinery - their recognition, appreciations and limitations - machining operations and accuracy.

Conventional tooling machines - shaper - planner - lathe – drilling - milling - horizontal, vertical & universal type – jig boring - grinding - pantograph engraving.

Unit III CNC Machines (6 Hours)

Different types of CNC machine tools - Lathe, Milling, VMC, EDM, Wire EDM - CAD integrated with CAM.

Introduction to tool room inspection-measuring instruments-co-ordinate measuring machine - taper and angle measurement techniques.

Unit IV (3 Hours)

Polishing Technology in Mould Making: Definition of surface roughness, basis of polishing technology - Effect of mould materials on polishability, Types of polishing tools, Methods of polishing - Basic information on ultra sonic polishing – Principles of Electro deposition in damaged moulding surfaces/Protective Coating.

Surface Texturing of Moulds – Process description, types of moulds, types of patterns and mould shapes, metals that can be etched, mould preparation, limitations of chemical texturing.

Unit V (3 Hours)

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- mould trial.

Text / Reference Books

1. Mould Making Hand Book, Stoeckert
2. Plastics Moulds and Dies, Sors
3. Injection Moulds, V.D.I
4. Mould Finishing and Polishing Manual, S.P.E
5. Computer Numerical Control Machines (CNC), Radhakrishnan, P
6. Fundamentals of Numerical Control Lock Wood F.B
7. CNC Setting & Operation Work Book Renshaw, Tom

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

**PD-PMD With CAD/CAM
SEMESTER – II**

PD 203 REVERSE ENGINEERING AND RAPID PROTOTYPING (27 hours)

Unit I Reverse Engineering (6 Hours)

Geometric Modeling: Types of Geometric models and Solid Models
Reverse Engineering: Meaning, Definition & application, Computer aided reverse engineering, Measuring devices -contact type, non contact type-CAD model construction from point cloud-preprocessing, point clouds to surface model creation, Geometric data acquisition, 3D reconstruction, Applications and Case Studies

Unit II Rapid Prototyping (3 Hours)

Introduction : Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications.

Unit III Liquid and Solid Based Rapid Prototyping systems (6 Hours)

Stereo lithography Apparatus, Fused deposition Modelling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications

Unit IV Powder Based Rapid Prototyping Systems (6 Hours)

Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations

Unit V Rapid Tooling (6 Hours)

Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Vacuum casting - Applications.

Text / Reference Books

1. Tool Design – Cyril Donaldson,
2. Production Technology by P.C.Sharma, S.Chand & Company,
3. Production Technology by Dr.R.K.Jain,
4. Jig and Fixture Design by Edward G.Hoffman, Thomson Delmer Learning,
5. Fundamentals of Press Tool Design by William Francis Walker.
6. Rapid prototyping: Principles and applications, second edition, Chua C.K., LeongK.F., and Lim C.S., World Scientific Publishers, 2003.2.
7. Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton,Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.
8. Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003.
9. Rapid Prototyping and Engineering applications : A tool box for prototypedevlopment, Liou W.Liou, Frank W.Liou, CRC Press, 2007.
10. Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr

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

**PD-PMD With CAD/CAM
SEMESTER – II**

PD 204 – PROCESS PLANNING & COST ESTIMATION (27 HOURS)

Unit I Introduction (1½ Hours)

Process planning and control – Introduction – objectives & importance – process planning – scheduling & control of production – Selection & Analysis – Steps involved in manual planning and computer aided process planning – merits and demerits.

Unit II Process planning activities for Mould manufacture (4½ Hours)

Introduction to Mould Manufacturing system, Details of mould manufacturing process - operation sequence, machine selection.

Documents in process planning (process layout, process sheets and route sheets with example) – process plans for machining typical components.

Unit III Estimating and Costing for mould manufacturing (7½ Hours)

Costing– Meaning, Types of costing and cost accounting methods.

Functions of estimation - Importance and aims of Cost estimates Difference between costing and estimation - Importance of realistic estimates - Estimation procedures.

Unit IV Elements of Costing (6 Hours)

Introduction - Material Cost - Determination of Material Cost - Labour Cost - Determination of Direct Labour Cost - Expenses - Cost of Product (Ladder of cost) - Illustrative examples. Analysis of overhead expenses - Factory expenses - Depreciation - Causes of depreciation - Methods of depreciation - Administrative expenses - Selling and Distributing expenses - Allocation of overhead expenses.

Unit V Cost Estimation (7½ Hours)

Proforma for cost estimation – product cost – estimation of machining time & costs - mould cost - Processing cost - project costing.

Text / Reference Books

1. Industrial Engineering Management – Khanna O. P.
2. T.R.Banga and S.C.Sharma, “Mechanical Estimating and Costing”
3. Sinha.B.P., Mechanical Estimating and Costing”, Tata McGraw-Hill Publishing Co.
4. Russell R.S. and Taylor, B.W.”Operations Management”, PHI,
5. Chitale.A.V. and R.C.Gupta, “Product Design and Manufacturing”, PHI,
6. Production Technology by P.C.Sharma, S.Chand & Company.
7. Adithan, M. S., and Pabla, Estimating and Costing, Konark Publishers Pvt., Ltd, 1989
8. Chitale, A. K., and Gupta, R. C., Product Design and manufacturing, Prentice Hall of India, New Delhi, 1997

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

**PD-PMD With CAD/CAM
SEMESTER – II**

PDL 205 - MANUFACTURING PRACTICE

(108 Hours)

Practical Exercises on Mould Parts

- | | |
|------------------------------------------------------------|-----------------|
| 1. Milling & Boring | <u>12</u> Hours |
| 2. Turning, thread cutting | <u>10</u> Hours |
| 3. Drilling, reaming & tapping | <u>10</u> Hours |
| 4. Grinding- wheel dressing, setting, balancing & grinding | <u>10</u> Hours |
| 5. EDM | <u>10</u> Hours |
| 6. Wire-EDM - programming & machining | <u>10</u> Hours |
| 7. CNC milling - programming & machining | <u>12</u> Hours |
| 8. CNC lathe - programming & machining | <u>12</u> Hours |
| 9. CNC EDM - programming & machining | <u>12</u> Hours |
| 10. Inspection & CMM | <u>10</u> Hours |

**PD-PMD With CAD/CAM
SEMESTER – II**

PDL 206 - DESIGN LAB - II

(270 Hours)

(To be conducted in CAD/CAM lab)

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|-------------------------------------------------------------------------|--------------------|
| 1. Introduction and practice on 3D modeling using UG NX /CREO/CATIA | (<u>50</u> Hours) |
| 2. Demonstration and practice on Mould Flow software | (<u>50</u> Hours) |
| 3. Compression mould design -open flash | (<u>21</u> Hours) |
| 4. Compression mould design - positive, semi-positive, | (<u>21</u> Hours) |
| 5. Transfer mould design | (<u>21</u> Hours) |
| 6. Extrusion Die Design | (<u>21</u> Hours) |
| 7. Design of Blow mould | (<u>21</u> Hours) |
| 8. Mould design for internal threaded components (automatic unscrewing) | (<u>22</u> Hours) |
| 9. Hot Runner Mould | (<u>22</u> Hours) |
| 10. Rotomould and thermoform mould design | (<u>21</u> Hours) |

Note : Design Practicals SI.No. : 3 to 11 shall be carried out by utilizing CAD software.

**PD-PMD With CAD/CAM
SEMESTER – III**

PDL 301 - PROJECT WORK**(378 Hours)**

Project work shall be carried out by the Students in a group comprising of 4 to 5 members. The type of project shall be selected by the course in-charge in consultation with the local industries.

The scope of the project work is given below:

1. Development of Product Design and Mould Design Drawings using any CAD Software
2. Checking the Mould Design using Mould Flow Analysis
3. Preparing Project report highlighting features of Product Design and steps followed in development of Mould Design and report on Mould Flow analysis
4. Students shall be encouraged to involve themselves in the mould development process
5. The final assessment will be through a Viva-voce by a committee of officials working in industries and department officials.

**PD-PMD With CAD/CAM
SEMESTER – III**

PDL 302 – INPLANT / INDUSTRIAL TRAINING: (54 Hours)

A report should be submitted by the student after successful completion of the same along with a certificate from the Industry. It will help the student to understand the Industry requirement for selection of product and executing the Project.

**PD-PMD With CAD/CAM
SEMESTER – III**

PDL 303 SEMINAR - CASE STUDIES ON PRODUCT & MOULD DESIGN (54 Hours)

Each student shall present a case study with part drawing and mould design as part of seminar in the class room in front of the students and shall be evaluated by the faculty. Suggested topics are given below for selection by faculty and allocation to the student. Student maybe encouraged to select automobile, electrical and other engineering products.

1. Two Plate Injection Mould
2. Three Plate Injection Mould
3. Multi Cavity Injection Mould
4. Stripper Plate Mould
5. Standard Mould Bases
6. Split Cavity Mould
7. Core Puller Mould
8. Collapsible Mould
9. Cooling System
10. Submarine Gate multi Cavity Mould
11. Automatic Unscrewing Mould
12. Gas assisted Injection Mould
13. Hot Runner Mould
14. Stack Mould
15. Multi Stage Injection Mould
16. Metal to Plastic replacement
17. Insert Moulding
18. Two layer two colour Injection moulding concept
19. Injection Blow moulding Process and Design
20. Stretch Blow moulding process and design
21. Thermoforming moulding process and design
22. Rotational moulding process and design
23. Mould elements – material selection process
24. Various heat treatment process for Mould elements
25. Mould Polishing & Mould maintenance
26. Product design features and requirement
27. Fastening / Assembly / Welding / joining of Plastics
28. Composite Material based Product design & Applications.
29. Rapid prototyping techniques
30. Reverse Engineering
31. Dealing with undercuts – Lifter / Collapsible core / Angle pin / Dog leg cam
32. Shrinkage Analysis for various plastic materials
