

DIPLOMA IN PLASTICS MOULD TECHNOLOGY

(DPMT)

SYLLABUS & CURRICULUM

REVISED: AUGUST 2014

Implemented from Academic Year 2014-15



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 MOULD TECHNOLOGY (DPMT) SYLLABUS

SEMESTER - I

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
GE 101	Communication English-I	72	08	3	40	60	100
GE 102	Engineering Mathematics	72	08	3	40	60	100
GE 103	Engineering Physics	72	08	3	40	60	100
GE 104	Engineering Chemistry	72	08	3	40	60	100
GE 105	Fundamentals of Computer Engineering	72	08	3	40	60	100
GE 106	Engineering Drawing-I	40	80	3	40	60	100
Total(20 weeks-26 Hours per week)		520		18	240	360	600
PRACTICAL							
GEL 107	Engineering Physics Lab	60		4	50	50	100
GEL 108	Engineering Chemistry Lab	60		4	50	50	100
MTL 101	Workshop Practice	120		8	100	100	200
	Library	40		-	-	-	-
Total(20 weeks-14 hours per week)		280		16	200	200	400

SEMESTER - II

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
GE 201	Communication English-II	72	08	3	40	60	100
GE 202	Applied Mathematics	72	08	3	40	60	100
GE 203	Fundamentals of Electrical and Electronics Engineering	52	08	3	40	60	100
GE 204	Engineering Drawing-II	40	60	3	40	60	100
MT 201	Machine Shop Technology-I	72	08	3	40	60	100
MT 202	Engineering Materials and Metallurgy	72	08	3	40	60	100
Total(20 weeks-24 hours per week)		480		18	240	360	600
PRACTICAL							
GEL 205	Electrical and Electronics Engineering Lab	40		4	50	50	100
GEL 206	Computer Engineering Lab	40		4	50	50	100
MTL 203	Machine Shop Practice-I	200		8	100	100	200
	Library	40		-	-	-	-
Total(20 weeks-16 hours per week)		320		16	200	200	400

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

DIPLOMA IN PLASTICS MOULD TECHNOLOGY (DPMT) SYLLABUS

SEMESTER - III

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
MT 301	Applied Mechanics & Strength of Materials	72	08	3	40	60	100
MT 302	Engineering Metrology	60	20	3	40	60	100
MT 303	Machine Shop Technology-II	72	08	3	40	60	100
PT 301	Plastics Materials & Testing	52	08	3	40	60	100
Total(20 weeks-15 hours per week)		300		12	160	240	400
PRACTICAL							
MTL 304	Machine Shop Practice-II	360		8	100	100	200
MTL 305	CAD Lab-I	40		4	50	50	100
PTL 302	Plastics Testing Lab	60		4	50	50	100
	Library	40		-	-	-	-
Total(20 weeks-25 hours per week)		500		16	200	200	400

SEMESTER - IV

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
MT 401	Fundamentals of Plastics Product and Mould Design	72	08	3	40	60	100
MT 402	Design of Machine Elements	72	08	3	40	60	100
MT 403	Mould Manufacturing Techniques	52	08	3	40	60	100
PT 401	Plastics Processing Techniques	52	08	3	40	60	100
Total(20 weeks-14 hours per week)		280		12	160	240	400
PRACTICAL							
MTL 404	Mould Manufacturing Practice-I	380		8	100	100	200
MTL 405	CAD Lab-II	40		4	50	50	100
PTL 402	Plastics Processing Lab	60		4	50	50	100
	Library	40		-	-	-	-
Total(20 weeks-26 hours per week)		520		16	200	200	400

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

DIPLOMA IN PLASTICS MOULD TECHNOLOGY (DPMT) SYLLABUS

SEMESTER - V

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
MT 501	Advanced Mould Manufacturing Techniques	72	08	3	40	60	100
MT 502	Process Planning and Cost Analysis	52	08	3	40	60	100
MT 503	Jigs, Fixtures and Gauges	72	08	3	40	60	100
Total(20 weeks-11 hours per week)		220		09	120	180	300

PRACTICAL						
MTL 504	Mould Manufacturing Practice -II	480	8	100	100	200
MTL 505	CNC Lab	60	4	50	50	100
	Library	40	-	-	-	-
Total(20 weeks-29 hours per week)		580	12	150	150	300

SEMESTER - VI

THEORY							
CODE	SUBJECT	CH	TH	EH	MARKS		
					INT	EXT	TOTAL
MT 601	Applied Mould Engineering	52	08	3	40	60	100
MT 602	Industrial Management and Entrepreneurship	52	08	3	40	60	100
Total(20 weeks-06 hours per week)		120		06	80	120	200

PRACTICAL						
MTL 603	CAM & CNC Lab	60	4	50	50	100
MTL 604	Project Work	580	8	100	200	300
	Library	40	-	-	-	-
Total(20 weeks-34 hours per week)		680	12	150	250	400

CH- Contact Hours

TH-Tutorial Hours

EH- Examination Hours

**DPMT
SEMESTER – I**

GE101-COMMUNICATION ENGLISH-I (80 Hours)

Unit I (16Hours)

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

Unit II (16Hours)

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 (16Hours)

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 (16Hours)

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 (16 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&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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – I**

GE 102 – ENGINEERING MATHEMATICS (80 Hours)

Unit I Algebra (16 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 nP_r and nC_r . Binomial theorem for a positive integral index

Unit II Complex Numbers (16 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 (16 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 (16 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 (16 Hours)

Limits: standard results

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

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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – I**

GE 103 – ENGINEERING PHYSICS (80 Hours)

Unit I UNITS & DYNAMICS (20 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 (20 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 (20 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 (20 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – I**

GE 104 – ENGINEERING CHEMISTRY (80 Hours)

Unit I – STRUCTURE AND BONDING (20 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 (20 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 (20 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 and 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 (20 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – I**

GE 105 – FUNDAMENTALS OF COMPUTER ENGINEERING (80 Hours)

Unit 1 (16 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 II (24 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 III (24 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 IV (16 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. Rapidex Computer course , Jayant pushtak mandal, Neogy.
3. Simplex Computer course –Ravi kant Taxali, Tata McGraw hill

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

**DPMT
SEMESTER – I**

GE 106 – ENGINEERING DRAWING – I (120 Hours)

Unit I (30 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 (40 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 (20 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 (30 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – I**

GEL 107 - ENGINEERING PHYSICS LAB

(60 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

**DPMT
SEMESTER – I**

GEL 108 – ENGINEERING CHEMISTRY LAB**(60 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.

**DPMT
SEMESTER – I**

MTL 101 – WORKSHOP PRACTICE (120 Hours)

Workshop Safety (10 Hours)

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

1. Familiarization of Workshop Tools (20 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 (20 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 (70 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.

**DPMT
SEMESTER – II**

GE 201- COMMUNICATION ENGLISH-II (80 Hours)

Unit I (16 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 (16 Hours)

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

Unit III (16 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 (16 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 (16 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – II**

GE 202 - APPLIED MATHEMATICS (80 Hours)

Unit I: Vector Algebra (16 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 (16 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 (16 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 (16 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 (16 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – II**

GE 203 - FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING (80 Hours)

Unit I: DC & AC Circuits: (16 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: (16 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: (16 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: (16 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: (16 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.

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).
- Mehta V K, "Principles of Electronics", S.Chand & Company Ltd, (1994).
- 3.B.L. Theraja, Fundamentals of Electrical and Electronics Engineering, S.Chand & Co.
- 4.T. Thiyagarajan, Fundamentals of Electrical and Electronics Engineering, Scitech
a. Publicatiuons (India) Pvt.ltd.
- 5.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.
- 6.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.
- 7.Gary Dummy, Introduction to Programmable logic controls, Thomson Debnar learning second edition second reprint 2003.
- 8.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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – II**

GE 204 – ENGINEERING DRAWING – II (100 Hours)

Unit I (28 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 (28 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 (14 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 (30 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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – II**

MT 201 – MACHINE SHOP TECHNOLOGY – I (80 Hours)

Unit I (20 Hours)

Metal cutting: Mechanism of metal cutting – general principles- orthogonal cutting - oblique cutting. Types of chips & chip formation on different materials. Cutting tools - Single point cutting tool – tool geometry – tool nomenclature. Machinability -tool life-factors that affect the tool life- tool wear-tool failure. Cutting tool materials – types, properties and applications. Multi point cutting tools. Metal cutting parameters -speed – feed - depth of cut.

Cutting Fluids : Purpose - Type of cutting fluids – Applications – Selection of a cutting fluid – Effect of coolants on cutting variables ie, Speed, Feed, Depth of cut and tool life for different materials.

Pedestal grinding machine - Types of machine- types & selection of grinding wheels - Sharpening of cutting tools.

Unit II Lathe (30 Hours)

Types of lathe – Lathe construction – lathe parts, function of each part. Lathe accessories & attachments – work holding and tool holding devices - Different types of operations –. Selection of cutting speed, feed and depth of cut for various operations & materials - cutting speed - empirical formulas, machining time calculation. Machine Installation procedure - Lathe specification–safety.

Unit III Shaping, Planning & Slotting Machines (16 Hours)

General use of a shaper – parts and their functions – shaper tool & Work holding devices- Quick return motion arrangements - adjustments of stroke- crank and slotted lever mechanism, Whitworth mechanism, Hydraulic shaper, Speed, feed and depth of cut for various materials. Work difficulties – chattering tool, warping of work- Shaper specifications- application of slotting machine & Planning machine, Difference between shaper , planner and slotter machines.

Unit IV Drilling Machine (14 Hours)

Type of drilling machines, tool holding devices, work holding devices, types of drills, elements of drills, Drill bit material and specifications ,Sharpening of drills. Speeds and feeds of tool on various metals such as cast iron, mild steel, harden alloy steel, brass and Aluminum.

Counter boring, counter sinking, Reaming-types of reamers, elements of reamers and drill hole size for reaming-safety while working. Bell mouth problem in reaming, over size due to lip out.

Hand taps, machine taps, drill hole size for tapping, tap wrenches, Dies–solid, split and adjustable dies stocks.

Text / Reference Books

1. Workshop Technology, Volume I & II - B.S. Raghuwanshi.
2. Production Technology - Dr. R.K. Jain.
3. Mechanical & Industrial Measurements - R. K. Jain, Khanna Publishers.
4. Production Technology - P.C. Sharma Pub: S. Chand and Co.
5. Workshop Technology, Volume I & II – W.A.J Chapman.
6. Elements of workshop Technology, Volume – II – S.K.Hajra Choudhury & A.K Hajra Choudhury.

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

**DPMT
SEMESTER – II**

MT 202 – ENGINEERING MATERIALS AND METALLURGY (80 Hours)

Unit I Crystallography (12 Hours)

Crystalline solids – Amorphous solids – Space lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – ‘d’ spacing in cubic lattice – Calculation of atoms per unit cell – Atomic radius – Coordination number and Packing factor for SC, BCC, FCC and HCP structures

Unit II Ferrous and Non-Ferrous Metals (20 Hours)

Ferrous Metals :

Classification of iron and steel - Manufacture of pig iron, wrought iron, cast iron and steel - Effect of various alloying elements on steel.

Non Ferrous Metals:

Properties and uses of nonferrous metals. Important ores and properties of aluminium, copper, zinc, tin, lead – Non ferrous alloys – Brass, Bronze, Gun metal and Beryllium Copper – properties and applications.

Unit III Heat Treatment (32 Hours)

Solid solutions – Substitution and interstitial – Phase diagrams - Isothermal transformation diagrams – cooling curves, Iron carbon equilibrium diagram, eutectoid and eutectic reactions. Time & Transformation (TTT) diagram.

Heat Treatment – Purpose –Types of Heat Treatment processes- Annealing, Normalising, Hardening - Hardening of Tool steels, Tempering – Types, Austempering & Martempering of steel. Quenching medium – Types and application. Case hardening processes, types & applications - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening- Process - Permeable case depth for different types of steels.

Advanced Heat treatment techniques - Vacuum hardening, Plasma Nitriding.

Unit IV Mechanical Properties and Testing (16 Hours)

Mechanical properties of metals-Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests. Hardenability, Jominy end quench test, Non Destructive Techniques.

Text / Reference Books

1. William D Callister “Material Science and Engineering”, John Wiley and Sons 2007.
2. Raghavan.V “Materials Science and Engineering”, Prentice Hall of India Pvt. Ltd, 2007.
3. Sydney H.Avnor “Introduction to Physical Metallurgy” McGraw Hill Book Company.
4. Dieter G. E., Mechanical Metallurgy, Mc Graw Hill Book Company, 1988.
5. O.P. Khanna, A text book of Materials Science and Metallurgy, Khanna Publishers.
6. Vijaya. M.S. and G. Rangarajan, Material Science, Tata McGraw-Hill, 2007.
7. Material science by R.S.Sedha, R.S.Khurmi, S.Chand publishers
8. Material Science and Engineering by R.K.Rajput, S.K.Kataria & Sons.

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

**DPMT
SEMESTER – II**

GEL 205 – ELECTRICAL AND ELECTRONICS ENGINEERING LAB (40 Hours)

1. Electrical Engineering Lab (20 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 (20 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 thermistor & zener diode.
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.

**DPMT
SEMESTER – II**

GEL 206 – COMPUTER ENGINEERING LAB**(40 Hours)**

1. Study of Computer Components
2. Practice of Computer Booting Process in XP
3. Demonstration of Windows Environment
4. Practice - using My Computer, Windows Explorer
5. Practice - using Control Panel
6. Practice - My Network Places
7. Practice - CD and DVD Writing
8. Practice - Paint
9. Installation of Windows XP by using NTFS File System.
10. Demonstration of Network
11. Creating e-mail Account , Sending and Receiving e-mails.
12. Searching Web Page/ Site using Search Engine :
(eg. google.com, yahoo.com, altavista.com etc.)

Exercise Based on MS-Word:

- 1.1 Document Preparation
- 1.2 Printing Document
- 1.3 Mail Merge usage
- 1.4 Draw Table

Exercise Based on Ms-Excel :

- 1.1 Work Book Preparation
- 1.2 Printing Workbook
- 1.3 Data-base usage
- 1.4 Draw Charts

Exercise Based on Power Point :

- 1.1 Creating Slide
- 1.2 Adding, Animations in Slide
- 1.3 Presentation

REFERENCE BOOKS :

1. Computer Fundamental V.K. Jain, Standard Pub.& Distributors
2. PC Software for Windows made simple R.K. Taxali, TMH
3. Mastering Windows XP TMH
4. Introduction to Networking NANCE, PHI
5. First Course in Computer Science Sanjeev Saxena, Vikas Publishing House
6. First Look Microsoft Office 2003 Murray, PHI

**DPMT
SEMESTER – II**

MTL 203 – MACHINE SHOP PRACTICE – I (200 Hours)

1. Pedestal Grinding (40 Hours)

Safety precautions - Sharpening of cutting tools - single point, knife tools, Form tools, parting and grooving tools, thread cutting tools.

2. Shaper (40 Hours)

Safety precautions -Familiarization with shaping machine- principal parts, work holding device, Cutting tools & tool - holding device - familiarize with the operations.

Shaping of a rectangular block - Shaping a 'V' groove in a rectangular block - Dove tail machining and square groove machining.

3. Drilling Machine (20 Hours)

Safety precautions - Familiarization with drilling machine- principal parts, work holding device, Cutting tools & tool holding device.

Marking and punching the lay out - Drilling and tapping operations - Drilling and Reaming operations - Counter boring and Counter sinking operations.

4. Lathe Work (100 Hours)

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

Plain turning and Step turning - Taper turning (Internal & External) - Drilling and Reaming - Boring and counter boring - Forming and grooving - Thread cutting and knurling - Combination of above operations - Eccentric turning.

**DPMT
SEMESTER – III**

MT 301- APPLIED MECHANICS & STRENGTH OF MATERIALS (80 Hours)

Unit I (20 Hours)

Equilibrium of Forces

Principles of equilibrium-Methods for equilibrium of coplanar forces - Analytical methods for the equilibrium of coplanar forces - Lami's theorem - Geographical methods for the equilibrium of coplanar forces - Converse of the law of triangle of forces - Converse of the Law of polygon of forces - Conditions of equilibrium - Types of equilibrium - Simple Problems.

Centre of Gravity

Centroid - Methods of centre of gravity of simple figures - Centre of gravity by geometrical considerations - Axis of reference - Centre of gravity of plane figures, symmetrical sections, unsymmetrical sections, solid bodies, sections with cut out holes - Simple Problems.

Moment of Inertia

Moment of Inertia of a Plane area - Units of moment of inertia - Methods of integration-Methods for finding out moment of inertia - Moment of inertia by Routh's rule - Moment of inertia of rectangular, square, triangle, circle and the semi circle section - Simple Problems.

Unit II (12 Hours)

Friction

Introduction - Types of friction -Static friction-Dynamic friction-Limiting friction-Normal reaction-Angle of friction - Co efficient of friction - Laws of friction - Simple Problems.

Simple Lifting Machines

Introduction - Types of lifting machine - Simple wheel and axle - Simple pulley- Simple screw jack - Simple Problems.

Unit III Simple Stresses and Strains (24 Hours)

Concept of Stress and strain, types of stresses, strains-, Hook's law, Elasticity, Modulus of Elasticity, Stress - strain diagram, Working stress and Factor of safety, State of simple shear, Modulus of rigidity, Bulk modulus, Poisson's ratio, Relationship between elastic constants, Deformation of body due to force acting on it, Deformation of body due to self weight, Principle of superposition, Stresses in bars of varying section, Thermal stresses in simple and composite bars - Simple Problems.

Unit IV Shear Force and Bending Moment (24 Hours)

Introduction, Types of loading - Shear force and bending moment, Sign conventions - Shear force and bending moment diagram - Relation between loading and bending moment - Cantilever with a point at its free end, Cantilever with a uniform distributed load - Simply supported beam with a point load at its mid-point - Simply supported beam with a uniformly distributed load - Simple Problems.

Deflection of Beams

Introduction - Methods for slope and deflection at a section - Simply supported beam with a central point load - Cantilever with a point load at its free end - Simple Problems.

Text / Reference Books

1. Strength of Materials – R.K. Rajput.
2. Strength of Materials – Dr. R.K.Bansal.
3. Strength of Materials – R.S. Khurmi.
4. Applied Mechanics – R.S. Khurmi.

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

**DPMT
SEMESTER – III**

MT 302 – ENGINEERING METROLOGY (80 Hours)

Unit I (10 Hours)

Introduction

Introduction to metrology – Objectives of Metrology – Need of Inspection– Measuring Instruments – Methods of measurement – Requirements & General care of instruments– Sources of Errors & Corrections of Errors – Accuracy and Precision.

Standards of Measurements

Standards of Measurements: Line standard, End Standard, Wavelength Standard – Classification of Standards – Characteristics of line and end standards.

Unit II (30 Hours)

Marking Tools - Scriber – surface gauges – dividers – V-blocks – Engineer's Parallels – Angle plates – surface plates.

Measuring Instruments - construction, application and least count. Steel rule – try square – vernier calipers – Vernier height gauges – Micrometers – outside & inside – depth micrometer – height Master – Bore gauges –slip gauges/Pins.

Comparators – Introduction & types of comparators, uses of comparators, difference between measuring instruments & comparators, mechanical comparators – Dial indicators, advantages & disadvantages, working principle of pneumatic comparators – solex air gauge, applications

Standard Gauges – Types of gauges, Radius gauge, Feeler gauge, Pitch Screw gauge, Taper wire & Thickness gauge, Plain gauge, Plug gauge, Snap gauge, Ring gauge, Combined limit gauge.

Unit III (16 Hours)

Angular & Taper measurements – Bevel Protractors and its types- combination set -Sine bar, Sine table and Sine centre - Angle gauges- Auto Collimator-Measurement of Taper using balls & Rollers.

Geometrical Measurements– Straightness, Flatness, Parallelism, Squareness, concentricity.

Unit IV (24 Hours)

Measurement of Surface Finish -Representation of surface finish as per BIS – Methods of measuring surface finish- Surface finish measuring machines Surface roughness – guide for selection, surface roughness obtainable from various manufacturing processes, surface roughness symbols, Hardness testing.

Advanced Measuring Equipments-Precision instruments based on laser - Principles - laser interferometer-application in measurements and machine tool metrology – Toolmakers microscope, Optical profile projector, Co-ordinate measuring machines – with & without scanner (non –contact & contact types), Optical flats – types and uses- computer aided inspection and continuous Measuring gauges.

Text / Reference Books

1. M.Mahajan, Engineering Metrology, 2005, Dhanpatrai & Co., New Delhi.
2. Garg.H.P, Industrial Maintenance, Reprint 2002, S.Chand & Co. Ltd., New Delhi
3. R.K.Jain, Engineering Metrology, 2002, Khanna Publisher, New Delhi.
4. R.K.Rajput, Engineering Metrology & Instrumentation, 4th Edition 2004, S.K.Kataria & Sons, New Delhi.

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

**DPMT
SEMESTER – III**

MT 303 – MACHINE SHOP TECHNOLOGY - II (80 Hours)

Unit I Milling Machines (32 Hours)

General use of milling machines, Parts of milling machines and their functions, Types of milling machines-horizontal-vertical - universal, Cutter holding devices - arbors - collets - adapters, Types of milling cutters - end mill, side and face cutter - shell end mill, helical end mill, carbide tipped cutters, choice of cutter, Setting of work – work holding devices - alignment – speed, feed and depth of cut on various materials. Milling operations - plain milling, key and key ways, gang milling, T – slot milling, Milling methods (a) conventional milling (b) climb milling (Up/Down milling). Construction of indexing head - Job accuracy - Machining time, maintenance & safety – coolants used for machining - lubricants & lubrication of machinery – preventive maintenance of machine tools-Milling machine specifications-safety while working.

Unit II Surface Grinding (16 Hours)

General use of surface grinding machines, Parts of surface grinding machines and their functions, Types and working principle - wet grinding and dry grinding, work and tool holding devices, grinding wheels – abrasives, bonds, grit, grade and structure of wheels – wheel shapes and sizes – mounted wheels – standard marking system – selection of grinding wheels – mounting the grinding wheels – glazing and Wheel loading – dressing and truing of grinding wheels – balancing of grinding wheels – diamond wheels - types and uses – speed and feed parameters – attachments –Plain surface- taper grinding – job accuracy – maintenance and safety.

Unit III Cylindrical Grinding (16 Hours)

General use of surface grinding machines, Parts of surface grinding machines and their functions, Types and working principle - wet grinding and dry grinding, work and tool holding devices, grinding wheels – wheel shapes and sizes – mounted wheels – standard marking system – selection of grinding wheels - balancing of grinding wheels – diamond wheels - types and usage – speed and feed parameters – attachments – concept of spark out – external and internal grinding- taper grinding – job accuracy – maintenance and safety.

Unit IV Tool and Cutter Grinder (16 Hours)

Types and working principle of Tool and Cutter Grinding Machine-Use of cutter grinding accessories and attachments-Nomenclature of Single and Multipoint Cutting Tools-Selections and Specification of Grinding Wheel for Cutter Materials-Method of Setting, Balancing, Truing, Dressing of Grinding Wheel -Procedure of forming of Grinding Wheels for sharpening of lathe & milling cutters.

Text / Reference Books

1. Workshop Technology, Volume-II - B.S. Raghuwanshi.
2. Production technology - Er. R.K. Jain.
3. Mechanical & Industrial Measurements - R. K. Jain, Khanna Publishers.
4. Production Technology - P.C. Sharma Pub: S. Chand and Co.
5. Workshop Technology, Volume I & II – W.A.J Chapman.
6. Elements of workshop Technology, Volume-II - S.K.Hajra Choudhury & A.K Hajra Choudhury.

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

**DPMT
SEMESTER – III**

PT 301 - PLASTICS MATERIALS & TESTING (60 Hours)

Unit I Polymer Science (8 Hours)

Introduction to Monomers and Polymers –Polymerisation –types of Polymerisation - condensation - addition - Copolymerisation, Characterization - Polymer solution - Measurement of molecular weight and size, Structure and properties of polymers.

Unit II Thermoplastic Materials (20 Hours)

Introduction – Types – Commodity & Engineering plastics-properties and applications of various plastics material - Polymer blends and alloys - Polymer composites.

Unit III Thermoset Materials (12 hours)

Properties – Processing Behaviour and Applications of Phenol Formaldehyde – Urea Formaldehyde – Melamine Formaldehyde – Unsaturated Polyesters – Alkyd Resins – Epoxy Resin – Polyurethane – Silicones.

Unit IV Plastics Testing (20 Hours)

Introduction & importance of testing – Significance of Identification of plastics - necessary manufacturing properties-Assessment of properties of finished products in relation to service requirements.

Standard & specifications - National and International standards - BIS, ASTM, ISO & NABL. Identification of common plastics materials by simple tests e.g., visual inspection, density, effects of heat, combustion and solvents, analysis with common solvents.

Preconditioning and test atmosphere - Testing of Mechanical, Thermal, Optical, Electrical properties, Permeability properties and Rheological properties.

Text / Reference Books

1. Plastics Materials, Brydson, J.A.
2. Text book of polymer science, Fred W Billmeyer.
3. Polymer Science V.R. Gowariker.
4. Principles Polymer Science P.Bahaabur & N.V. Sastry, Narosa Publishing House.
5. Text Book on Fundamentals of Plastics Testing - Prof. (Dr.) S.K..Nayak.

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

**DPMT
SEMESTER – III**

MTL 304 MACHINE SHOP PRACTICE – II (360 Hours)

Understand safety precautions

1. Milling Machine (120 Hours)

- 1.1 Familiarization with milling machine - principal parts, work holding device, Cutting tools & tool holding device.
- 1.2 Plain surface milling.
- 1.3 Slot milling-plain and angular milling.
- 1.4 Pocket milling.
- 1.5 Indexing milling.
- 1.6 Rotary milling.

2. Surface Grinding Machine (60 Hours)

- 2.1 Familiarization with grinding machine- principal parts, work holding device, grinding wheels.
- 2.2 Plain surface grinding.
- 2.3 Slot grinding.
- 2.4 Angular surface grinding.
- 2.5 Form grinding.

3. Cylindrical Grinding Machine (60 Hours)

- 3.1 Familiarization with cylindrical grinding machine- principal parts, work holding device, grinding wheels.
- 3.2 Plain, taper and step external grinding.
- 3.3 Straight and taper internal grinding.
- 3.4 Form grinding.

4. Tool and Cutter Grinding Machine (60 Hours)

- 4.1 Familiarization with Tool and cutter grinding machine- principal parts, work holding device, grinding wheels.
- 4.2 Grinding of single point, Form Tool, Drill, Reamer and Milling Cutters (Side face, End mill, Plain, Double angle cutters).

5. Lathe Machine (60 Hours)

- 5.1 Turning of guide pillar and guide bush.
- 5.2 Turning of sprue bush.
- 5.3 Turning of support pillar and bush.
- 5.4 Ejector pins and Push Back pins.

**DPMT
SEMESTER – III**

MTL 305 CAD LAB – I**(40 Hours)****1. Introduction to Computer Aided Drafting**

History – application – Advantages over manual drafting – Hardware requirements – Software requirements – Different software - Auto CAD – Pro E – IDEAS and Open Source drafting software etc:-, CAD basics – main menu, starting a new drawing, drawing editor, entering commands using mouse, pull down menu, getting help, data entry, entity selection, error correction.

2. Working with CAD

Setting limits of Drawing, grid, snap, co-ordinates, orthomode, zooming, drawing lines, arcs, circles, erase, undo, oops – commands, save and end commands- Editing, Adding dimensions and text, Editing drawings using various modified commands. Add dimensions and text on drawings, copy, mirror, array, fillet, chamfer, hatching the sectional views. Developing simple orthographic views and dimension it with text. Developing detailed orthographic views with all features.

**DPMT
SEMESTER – III**

PTL 302 – PLASTICS TESTING LAB

(60 Hours)

1. Determination of density of plastics.
2. Determination of melt flow index of plastics.
3. Determination of moisture contents.
4. Determination of carbon contents.
5. Determination of filler content.
6. Identification of plastics by simple methods.
7. Determination of water absorption.
8. Determination of Hardness(Rockwell, shore A&D, Barcol).
9. Specimen preparation methods.
10. Introduction to product testing - Pipe testing.

**DPMT
SEMESTER – IV**

MT 401 – FUNDAMENTALS OF PLASTICS PRODUCT AND MOULD DESIGN (80 Hours)

Unit I (16 Hours)

Product Design - Plastics product design - Concepts - Essential factors - Principles - Methodical approach -process variables vs product design. Uniform and symmetrical wall thickness - Draft angle- Rib design – Fillets & Radius - Bosses - Holes -Threads - standard thread forms - undercuts - Hinges - metal inserts - parting line –Tolerances- Design for manufacturing and assembly.

Unit II (32 Hours)

Injection Mould Design- Introduction -General mould construction- Mould design concepts - mould elements - parting line and parting surface- construction of core and cavities- Bolsters - mould alignment, Feed system- Sprue, runner, gate & position of gate - runner & gate balancing, Ejection - types of ejections - mould cooling -venting- ancillary parts. Two plate mould - three plate - external undercut- split mould, Side cores, Split and side core actuation-Finger cam-Dog leg cam - cam track - delayed action - hydraulic, internal undercut-form pin-collapsible core - loose cores, threaded inserts - internal and external threads-unscrewing moulds-hot runner moulds.

Unit III (16 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.

Unit IV (16 Hours)

Compression Mould Design - Types of compression mould, 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.

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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – IV**

MT 402 – DESIGN OF MACHINE ELEMENTS (80 Hours)

Unit I (20 Hours)

Introduction to design process-basic procedure of machine design- basic requirements of machine elements-design of machine elements-factors to be considered when designing a machine element-types of loading-basic definitions of mechanics (mass, weight, pressure, stress, torque, bending moment, momentum, couple, work, power)-mechanical properties of materials-selection of materials- Design stress and working stress – factor of safety- direct, bending, tensile and impact stress equations-theory of failures-simple problems.

Unit II (24 Hours)

Design of Shafts-types of shafts-shaft material-allowable stress for shaft, Design of shaft based on strength-design of solid and hollow shafts subject to twisting and bending moment, Design of shaft based on rigidity-torsional and lateral rigidity -simple problems.

Design of Bolts, Pins and Keys: Bolt – Stud – Nut – Design of bolted joints – Design of cylinder cover studs – Taper pins – Type of keys – sunk keys – Feather keys –spline shafts – Design of sunk key – Effect of Key ways - simple Problems

Design of Cotter Joint and Couplings: Design of – Sleeve and cotter joint – socket and spigot joint – rigid flange couplings – Problems.

Unit III (16 Hours)

Design of Bearing: Types of bearing – Ball bearing – Radial and thrust ball bearing – Single row – Double row – Self aligning bearings – Roller bearings – Cylindrical, Spherical, Needle and taper – Standard dimensions and designation of bearings – Materials used for ball and roller bearings – Lubrication of bearings – Journal bearing - simple Problems.

Unit IV (20 Hours)

Springs -Introduction – Types of springs – Laminated and coiled springs – Types of coiled springs – Difference between open and closely coiled helical springs – closely coiled helical spring subjected to an axial load – simple Problems.

Design of Gears: Type of Gears – Gear materials – Spur gear terminology – Design procedure for spur gear– simple Problems.

Text / Reference Books

1. A text book of Machine Design – R.S. Khurmi and J.K. Gupta.
2. A text book of Theory of Machines – R.S. Khurmi and J.K. Gupta.
3. A text book of Strength of Materials – Dr. R.K. Bansal.
4. Machine Design – Dr. Sadhu Singh.
5. Theory of Machines and Mechanisms – P.L. Ballaney.
6. Pandya & Shah, Machine Design, Edn. 1995, Charotar Publishing House.
7. S.E.Sundararaja Moorthy & N. Shanmugam, Machine Design, Revised Edn. June 2003, Narayana. Publications, No.1, M.I.G. Block, Second Avenue, Indira Nagar, Chennai 600 020 – 2004.
8. Design Data Book, by PSG College of Technology, Revised Edn. 1978 published by Kalakathir. Achagam, Kalakathir Buildings, 670 Avinasi Road, Coimbatore 641 037 – 2004.

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

**DPMT
SEMESTER – IV**

MT 403- MOULD MANUFACTURING TECHNIQUES (60 Hours)

Unit I (16 Hours)

Types of Mould Steels- Mild Steel, Alloy Steel, Die Steel etc, Mould steel requirement – characteristics – alloying elements – material selection for different parts of the Mould and their heat treatment.

Non ferrous materials – Aluminum -copper – bronze – beryllium copper-synthetic rubber and its significance as a material for Mould making.

Unit II (16 Hours)

Introduction to Jig Boring Machine-Working Principle-edge finder-locating microscope, Digital Read Out (DRO) - Types of tools and cutter used on jig boring and their materials-Types of measuring instruments used for inspection of job & their working principle-Application of Jig boring machine in mould manufacturing.

Pantograph-construction-working principle-tools-single lip cutters & profiles-single lip grinding machine. Templates – purpose, types, materials, methods of making templates, Introduction to Master and difference between Template and Master. Alignment of Workpiece and Template. Pantograph ratio.

Unit III (16 Hours)

Electrical discharge machining – working principle-construction- generator parameters-spark gap calculations, Electrodes – Materials used, properties and its application – wear ratios - Electrode design consideration. Die electric fluids –requirement, characteristics – Flushing – Purpose and different types of flushing. Troubleshooting – Faults and remedies.

Unit IV (12 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.

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

**DPMT
SEMESTER – IV**

PT 401 – PLASTICS PROCESSING TECHNIQUES (60 Hours)

Unit I (20 Hours)

Injection Moulding - Basic principles - Types of injection moulding machines-specifications- Various parts of injection moulding machine and its functions - process variables - temperature - pressure - time - moulding cycle - types of clamping - Mould setting - Shrinkage control - defects - causes and remedies of the common moulding faults - operator safety and routine quality control.

Introduction to Advance Injection Moulding Processes-Gas assisted injection moulding, Reaction injection moulding, Multi-colour injection moulding

Unit II (16 Hours)

Extrusion - Introduction - Extruder parts - Extruder screw - Design features - Extruder output – Extrusion processing parameters - Their effects on product quality - Extruded products - 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 - operator safety and routine quality control.

Blow Moulding - Introduction to blow moulding - types - Extrusion blow moulding – injection blow moulding - stretch blow moulding - parison programming - blow mould construction - setting and operation - mould cooling - clamping force - cycle time - moulding faults - causes and remedies - operator safety and routine quality control.

Unit III (12 Hours)

Compression & Transfer Moulding – Fundamental principles - Bulk factor - Flow properties - Processing temperature - Mould temperature control - Moulding pressure - Press tonnage – Processing limitations - Curing time - Influence of processing parameters on the quality of the moulding - Setting of moulding conditions for a particular job - Pelletizing – Preheating - Defects - Causes - operator safety and routine quality control..

Unit IV (12 Hours)

Thermoforming - Introduction – Thermo forming methods - Thermo forming moulds - Thermo forming equipment description – Temperature control - Cycle time - Defects, Causes and Remedies – operator safety and routine quality control.

Rotational Moulding - Basic principle - Material selection & 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 & Finishing – Fault - Causes & Remedies - Merits & Demerits of Rotational Moulding Process- operator safety and routine quality control.

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 and one periodical test is mandatory from each unit.

**DPMT
SEMESTER – IV**

MTL 404 - MOULD MANUFACTURING PRACTICE - I

(380 Hours)

Development of various Hand moulds (Injection/Blow/Compression/Transfer).

1. Familiarization of conventional machine tools-lathe-milling-surface grinding-cylindrical grinding tool and cutter grinding, cutting tools and cutting fluids.
2. Turning of mould elements-Sprue bush, guide pillar, guide bush, ejector pins etc.
3. Familiarization of cylindrical grinding operation to maintain functional dimensions of hardened guide pillar, guide bush, core and cavity and other elements of mould.
4. Rough machining using shaping machine (Bolster/Mould plates).
5. Surface grinding of mould plates and mould elements.
6. Drilling, reaming and tapping of mould plates and mould element.
7. Precision machining of guide pillar & guide bush holes in mould plates using Jig boring machine.
8. Rough machining of Core and Cavity of moulds using Lathe/milling machine.
9. Machining of Core and Cavity of moulds using precision machine tools.
10. Machining of intricate shapes of Core and Cavity (soft/hardened) using EDM.
11. Polishing of core, cavity, sprue bush, runner, gate etc to mirror finish.
12. Engraving and embossing of script & monograms.

**DPMT
SEMESTER – IV**

MTL 405 – CAD LAB - II**(40 Hours)****1. Working with CAD**

Production drawing development for various mould elements and mould base design in CAD.

2. 3D Modeling Exercises

3D part design-core and cavity design, electrode design.

**DPMT
SEMESTER – IV**

PTL 402 – PLASTICS PROCESSING LAB

(60 Hours)

1. Injection Moulding Machine - Semi Automatic

- (i) Safety precautions to be taken in Shop floor
- (ii) Study of Semi Automatic Injection Moulding machines of all types in IRO, Comparative study of Pneumatic type & Hydraulic type of machines, Operating Principle, Line diagrams with nomenclature of parts, Machines specifications.
- (iii) Operational practice of Pneumatic & Hydraulic type of Semi automatic Injection moulding machines to produce components in different moulds. Cycle-time analysis, observations of Process- Parameters & Procedure. Recording the observation and results in practical record books.

2. Injection Moulding Machine - Automatic

Study of machine Parts & function, Study of clamping systems, Technical specifications, study of process sequence, Study & definitions of terms related to machine operation e.g. Machines Day light, Locating Ring, Dimensions, ejector-stroke, Tie-Bar distance, Machine Platen sizes & mould clamping arrangements. Definitions of all Processing Parameters & study of controls in machines, Recording the observations and results in practical record books.

3. Blow-Moulding - Semi-Automatic and Fully Automatic

Study of Blow Moulding machines, Free-sketch of machine with parts & study of part-function, Technical specifications of machine, Mould clamping, operational practice with different moulds, familiarisation with control-switches / valves on the machine, cycle-time analysis & operational procedure of machine, Recording the observations and results in practical record books.

4. Compression and Transfer moulding

- (i) Study of compression moulding machine in IRO, Free sketch of parts & study of part-function, comparison of compression moulding machine with Injection Moulding machine.
- (ii) Operating Principle of Compression Press, mould setting procedure & parameter setting, operational practice on different compression and transfer moulds, Machine specification, Recording the observations and results in practical record books.

5. Extrusion Process

- (i) Study of Extruders in IRO, Free sketch of machines, their parts and functions, Products manufactured by Extrusion process, Study of different types of extrusion process.
- (ii) Operational practice by Trainees on setting up of Process parameter to produce Blown Film, observations on extruder output, size of film produced and technical specifications of machines to be recorded.

6. Introduction to Maintenance

Basic knowledge of Hydraulic & Pneumatic systems - Hydraulic fluid - Viscosity - Directional valves - Hydraulic pumps - Types & functions - Electrical system - Resistance - Voltage - Power - Electrical heaters - Thermocouples and temperature controls - Timers - Electric motors - Types & functions.

**DPMT
SEMESTER – V**

MT 501 – ADVANCED MOULD MANUFACTURING TECHNIQUES (80 Hours)

Unit I (16 Hours)

NC Machines – Basic components of NC system - NC procedure- NC coordinate systems - Types of motion – NC format -Numerical control vs Conventional machine tools - Advantages & Disadvantages of NC machines.

CNC Machine Tools-Introduction - Comparison of CNC with NC system-functions of CNC Control in Machine tools-types of CNC system-According to - types of motion control systems, programming modes & control loops–Analog and digital controls, Modes of machine operation in CNC machine, Advantages & Disadvantages of CNC machines.

DNC system- components of DNC system - Advantages of DNC, Combined DNC and CNC system.

Different types of CNC machine tools - safety & maintenance of CNC machines.

Unit II (36 Hours)

Milling and Machining Centre –classification of CNC milling machine -cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC milling- Preparatory and miscellaneous functions and formats of CNC milling programs-Canned cycles for CNC milling operations-simple programming for CNC milling operation for making mould elements.

Lathe and Turning Centre-Difference between machining centre and turning centre-axis designation of CNC lathe- types & classification of CNC lathe- cutting tools and tool holding devices-work holding devices- part programming structure and format-coordinate system for CNC lathe- Preparatory and miscellaneous functions and formats of CNC turning programs-Canned cycles for CNC turning operations-simple programming for CNC lathe operation for making mould elements.

Unit III (16 Hours)

CNC EDM – Introduction, principles of operation, theory of metal removal, electrode size, advantages and disadvantages of EDM -simple programming for CNC EDM operation for making mould elements.

CNC Wire EDM-Introduction and applications-Selection of wire- simple programming for CNC wire EDM operation for making mould elements, U, V axes.

Unit IV (12 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.

Text / Reference Books

1. Mould Making Hand Book, Stoeckert.
2. Plastics Moulds and Dies, Sors.
3. Injection Moulds, V.D.I.
4. Computer Numerical Control Machines (CNC), Radhakrishnan, P.
5. Fundamentals of Numerical Control Lock Wood F.B.
6. CNC Setting & Operation Work Book Renshaw, Tom.
7. CNC Technology & Programming Krar & Gill.
8. Numerical Control of Machine Tools Martin S.J.
9. Programming of computer numeric controlled machines polywka, John & Gabrel, Stanley.
10. CAD/CAM/CIM, R.Radhakrishnan, S.Subramanian, V.Raju, 2nd, 2003, New Age International Pvt. Ltd.
11. CAD/CAM, Mikell P.Groover, Emory Zimmers Jr. Indian Reprint Oct 1993, Prantice Hall of India Pvt., Ltd.
12. S.K.Sinha, NC Programming, I Edition, 2001, Galgotia Publications Pvt. Ltd.
13. Computer Aided Manufacturing, C.Elanchezhian , T.Sunder Selwyn & G.Shanmuga Sundar.

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

**DPMT
SEMESTER – V**

MT 502 - PROCESS PLANNING AND COST ANALYSIS (60 Hours)

Unit I Introduction (16 Hours)

Scope of Industrial Engineering – concepts of industry – production and productivity – difference – importance – methods of increasing productivity – expectations for productivity. Time study- Norms & component/ operation cycle time, tag time, stage time, allowance as per ILO.

Method study – Definition – Objectives-Motion economy- Principles – Tools and Techniques -Applications – Work measurements - purpose – use – procedure – tools and techniques - Standard time – Ergonomics MTM techniques – principles – applications.

Unit II Process Planning (16 Hours)

Definition – Objectives – Scope – approaches to process planning- Process planning activities – Finished part requirements - operating sequences - machine selection – material selection parameters- Set of documents for process planning - Developing manufacturing logic and knowledge- production time calculation – selection of cost optimal processes.

Unit III Cost Estimation (12 Hours)

Objective of cost estimation make or buy decision, Zero base budgeting - costing – cost structure on components & its accounting- classification of cost- Elements of cost. Types of estimates – methods of estimates – data requirements and sources- collection of cost-allowances in estimation.

Unit IV Manufacturing Cost Estimation (16 Hours)

Principal constituents of estimating the cost of a component based on dimension analysis– design time – drafting time – method study – time study – planning and production time – experimental work – labour – material –overheads - miscellaneous allowance – steps in estimating procedure – standard estimate forms.

Estimation of weights and materials – principles of dividing its component drawing into simpler and smaller geometrical configurations – calculation of volumes and weight of material - estimation of cost – exercise the calculation of weight of material and cost– estimation of machine times – basic formulae for calculation of machining times for the operation such as turning – drilling –shaping – boring – screw cutting – grinding – milling – use of standard tables for feeds and cutting speeds – exercises in calculating the machine times for the above mentioned operations – simple problems based on DFM (Design For Machine) & DFA (Design For Assembly)

Text / References Books

1. T.R Banga and S.C Sharma , “Mechanical Estimating and Costing”.
2. Sinha.B.P. “Mechanical Estimating and Costing”, Tata McGraw-Hill, Publishing Co., 1995.
3. Phillip. F Ostwalal and Jairo Munez, “Manufacturing Processes and systems”, John Wiley, 9th Edition, 1998.
4. Russell R.S. and Tailor, B.W, “Operations Management”, PHI, 4th Edition, 2003.
5. Chitale.A.V. and Gupta.R.C., “Product Design and Manufacturing”, PHI , 2nd Edition, 2002.

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

**DPMT
SEMESTER – V**

MT 503 – JIGS, FIXTURES AND GAUGES (80 Hours)

UNIT I Basics of Jigs and Fixtures (16 Hours)

Introduction – Jigs and Fixtures – Difference between Jigs and Fixtures – Advantages of Jigs and Fixtures – Elements of Jigs and Fixtures – Fool Proofing – Materials used in Jigs and Fixtures – Degrees of freedom - 12 degrees of freedom - 6 degrees of freedom – 6 points location principle (or) 3-2-1 principle of location - Essential features of Jigs and Fixtures.

UNIT II Principles of Location and Clamping (20 Hours)

Principles of location – location point – types of locators – pins and studs – V block – cup and cone location points – adjustable locating points – special adjustable stops – location from finished holes in the work – Diamond pin locator – Cam operated ‘V’ locator – Quick action ‘V’ locator.

Principles of clamping – types of clamps – lever clamp – hinged clamp – two way clamp – Swinging clamp – wedge clamp – eccentric clamping arrangement – Quick action clamp – Cam operated clamp - Quarter turn screw – Toggle clamp – Pneumatic and Hydraulic clamps – Washers- ‘C’ Washer – Spherical and flat Washers.

UNIT III (24 Hours)

Jig Bushings: Materials for Jig bushing – press fit bushings – Fixed renewable bushings – slip renewable bushings – liner bushings – screw bushings - miscellaneous type of drill bushings – bushing specifications.

Drill Jigs: Open drill jig – plate drill jig – template drill jig – channel drill jig – turn over drill jig – angle plate drill jig – closed box drill jig – leaf drill jig – Post jig – Pot jig - indexing drill jig – universal drill jig.

Fixtures: Elements of fixtures –Types of fixtures – Mandrels – Type of mandrels - Boring fixtures – Milling fixtures – Essentials of milling fixtures - Method of locating milling fixtures with respect to cutter position – Grinding fixtures – Surface grinding and cylindrical grinding fixtures - Broaching fixtures – Internal and External broaching fixture - Welding fixtures - Consideration for welding fixtures – Study of Assembly and Inspection fixtures.

UNIT IV Gauges (20 Hours)

Introduction – Limits gauges –Taylor’s principle of limit gauging – Application of limit gauges – Gauge makers tolerance – Allowance for gauge wear – Material for limit gauge – Three basic types of limit gauges – Disposition of gauge tolerance and wear allowance – Plug gauge – Snap gauge – Ring gauge – Thickness and length gauges – Recess gauge – Step gauge – Position and receiver gauges – IS specifications for gauges.

Text Books:

1. Donaldson.C and Others, "Tool Design", Tata McGraw Hill, 1978.
2. Kempster, "Introduction to Tool Design and Jigs and Fixtures", ELBS.

References Books:

1. ASTME, "Hand book of Fixture Design".
2. Korsakov, "Fundamental of Fixture Design", MIR Publication, Moscow.
3. Goroshkin.A.K., "Jigs and Fixtures Handbook", MIR Publication, Moscow.
4. Houghton, "Jigs & Fixture Design".
5. P.H.Joshi "Jigs & Fixtures".

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

**DPMT
SEMESTER – V**

MTL 504 - MOULD MANUFACTURING PRACTICE – II

(480 Hours)

Development of Automatic injection, compression, transfer and blow moulds

1. Familiarization of conventional machine tools-lathe-milling-surface grinding-cylindrical grinding-tool and cutter grinding, cutting tools and cutting fluids.
2. Familiarization of CNC machine tools-Lathe-Milling-EDM-Wire EDM, cutting tools and cutting fluids.
3. Rough machining of Sprue bush, guide pillar, guide bush, ejector pins etc.
4. Familiarization of cylindrical grinding operation to maintain functional dimensions of hardened guide pillar, guide bush, core and cavity and other elements of mould.
5. Rough machining using shaping machine (Bolster/Mould plates).
6. Surface grinding of mould plates and mould elements.
7. Drilling, reaming and tapping of mould plates and mould element.
8. Precision machining of guide pillar & guide bush holes in mould plates using Jig boring machine and CNC milling machine.
9. Rough machining of Core and Cavity of moulds using Lathe/milling machine.
10. Precision machining of Core and Cavity of moulds using CNC machine tools.
11. Machining of intricate shapes of Core and Cavity (soft/hardened) using CNC EDM & CNC Wire EDM.
12. Polishing of core, cavity, sprue bush, runner, gate etc to mirror finish.
13. Engraving and embossing of script & monograms.
14. Mould assembly practice.
15. Inspection of various systems of mould (Aligning system / core / cavity / cooling system / ejector system / feeding system / venting system / clamping system / moulding surface polishing etc.).

**DPMT
SEMESTER – V**

MTL 505 – CNC LAB

(60 Hours)

1. Familiarisation of NC & CNC machine tools.
2. Familiarisation of cutting tools and cutting fluids.
3. Programming and operating of CNC lathe machine.
4. Programming and operating of CNC milling machine.
5. Programming and operating of CNC EDM.
6. Programming and operating of CNC Wire-EDM.

**DPMT
SEMESTER – VI**

MT 601– APPLIED MOULD ENGINEERING (60 Hours)

Unit I (20 Hours)

Fits and Tolerances - Need of preparing a manufacturing drawing - components of a production drawing Limits, , Dimensional tolerance – Hole basis and shaft basis system-Select dimensions form B. I. S. standard to obtain clearance, transition and interference fit for a given set of mating parts. Computation of fits and tolerances form B. I. S. table – Preparation of drawings of mating parts and representation of fits and tolerances, Allowances.

Surface Roughness – Surface Roughness terminology – Roughness grades number, value and symbol - Symbols indicating surface texture – Relation between surface finish and manufacturing process. Symbols representing direction of lay, operations. Surface finish of various mould elements.

Unit II (20 Hours)

Geometric Dimensioning & Tolerancing (GD&T) -Introduction -Dimensioning and Tolerancing Fundamentals – Dimensioning Features – Features Control Frame – Datum Feature – Dimensioning Characteristics & Symbols, - Form - Orientation- Position, General - Position, Location- Position, Coaxiality- Concentricity and Symmetry- Runout- Profile – Rules to GD&T - Strategy for tolerancing Parts-tolerance of various mould elements, Cost impact on GT.

Unit III (10 Hours)

Standard mould parts- different standards -List of standard mould elements-Advantages of using standard items in mould making-Selection of standard mould elements.

Unit IV (10 Hours)

Rapid Prototyping & Tooling

Introduction to Proto type & Rapid proto type (RPT) – Difference between rapid tooling & conventional tooling – Rapid proto type methods – Rapid tooling for molding process – 3D Printing- vacuum casting – application and benefits.

Text / Reference Books

1. Machine drawing - P.I. Vargheese.
2. Machine drawing - K.C. John.
3. CIPET Mould Design Data Book.
4. Mould Design by R.G.W. Pye.
5. Mould Design Guide By Peter Jones.
6. Workshop Technology, Volume – II – B.S. Reghuwanshi.
7. Elements of Workshop Technology , Volume – II – S.K. Hajra Choudhury & A.K. Hajra Choudhury.
8. Production Technology – R.K. Jain.

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

DPMT

SEMESTER – VI

MT 602 – INDUSTRIAL MANAGEMENT & ENTREPRENEURSHIP (60 Hours)

Unit I (12 Hours)

Principles of Management

Introduction – meaning of management: - 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, functional, 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 (12 Hours)

Quality Planning and Control

Definitions of quality, Requirements of quality, list objectives of quality planning – quality control: -operator’s quality control, inspectors quality control, Mangers quality control, total quality control.

Quality Assurance: - Concept, definition, responsibility of quality assurance department, planning for quality assurance, based on reliability engineering.

ISO 9000 & Implementation

Concept and role of ISO 9000, what is ISO 9000, whom does it help, clauses in ISO 9000, steps for implementation of quality system - preparatory step, implementation step, registration & certification step. Quality Audit - objectives, types of audits, Benefits of becoming an ISO 9000 company. Introduction of Q.S, T.S, IS14000 & safety standards.

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 and TQC (Total quality control) importance of CI (continuous improvement), 5S principles.

Quality Circles - concept, characteristics, Brain storming method for solving Q.C. Problems. Small group activation.

Unit III (12 Hours)**Material Requirement Planning (MRP)**

MRP objectives & functions – Terminology – MRP systems – MRP outputs – Management information from MRP – Lot sizing considerations – Examples – applications – introduction to MRP – II - Just in time (JIT).

Unit IV (12 Hours)**Industrial Psychology**

Meaning, importance of good working conditions and environment: - physical working conditions, psychological working conditions, working conditions related to time, related to social situation. Behavioural dynamics: - self concept and self understanding, inter personal needs, developing interpersonal relationship: - developing mutual expectations, honouring psychological contacts, developing trust & influence, projecting positive qualities and hiding negative points – developing better behaviour and qualities a TQM approach: - conducting 'SWOT' analysis for self understanding, prepare incremental projects to reduce weakness and threats – mission statement

Small Scale Industries – Entrepreneur

List 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 V (12 Hours)**Industrial Safety**

Define Accident, Frequency rate, severity rate, and accident proneness. List the causes of accidents: - Mechanical, Environmental, personnel factors accident prevention techniques – 4 E'S of Accident prevention technique

Environmental Pollution and Control

Ecology and Eco system, Impact of industrial development on environment, Causes and effects of air and water pollution on plant, animal life and material, Characteristics of industrial and municipal waste, Treatment processes:- Primary, secondary and tertiary, Sources of air pollutants on human beings, Effects of air pollutants on human beings, Prevention and control of air pollution, Solid waste management, Environment pollution control legislation and functions of pollution control boards, Causes of noise pollution and its control.

Text / Reference Books

1. O.P. Khanna, Industrial Engineering and Management, Revised Edition – 2004, Dhanpat Rai Publications (P) Ltd., 67/4 Madras House, Daryaganj, New Delhi 110 002.
2. Industrial Engineering & production management – Martand.T.Telsang S.chand & Company.
3. Industrial Engineering & Management - O. P. Khanna.
4. TQM - B. Senthil Arasu & J.Praveen Paul Scitcch Publications.
5. ISO - Tapan.P.Bagachi.
6. Entrepreneurship Development - Jagmer Singh Saihi.
7. Industrial Management & Engineering Economics - Banga & Sharma.

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

**DPMT
SEMESTER – VI**

MTL 603 – CAM & CNC LAB**(60 Hours)**

1. Familiarisation with CAM software.
2. Familiarisation with CNC lathe / CNC milling / CNC EDM / CNC Wire EDM.
3. Study of international standards G-Codes, M-Codes.
4. Familiarisation of various cutting tools used for CNC machines.
5. Developing CAM programme for various elements of moulds.
6. Familiarisation CAM programme to CNC machines.
7. Machining of mould elements (3D profiles) using CAM programmes.
8. Practical exercise on CNC lathe / CNC milling / CNC EDM / CNC Wire EDM.
9. Familiarisation with CMM operations on quality control.

**DPMT
SEMESTER – VI**

MTL 604 – PROJECT WORK**(580 Hours)**

The following activities are envisaged in this course of study.

1. Project work for all trainees consisting a group of trainees.
2. The types of projects will have to be selected by the course in-charge in consultation with the local industries.
3. The scope of the project work should be Design and development of any one mould (Injection, transfer, compression, blow).
4. Identification and selection of a product that has a demand in the market.
5. Preparation of production / process drawing.
6. Procure the raw materials, equipments (if reqd.) and tools needed for manufacturing fully assembled mould with good quality.
7. Manufacture the mould with available facilities in the Institute.
8. Checking the finished product with original drawings of design and manufacturing with suitable modification if necessary.
9. Preparing project report consisting of production / process planning, plant layout needed for raw materials, equipments, tools, cost of manufacturing and all other details.
10. Review of project work: To develop the communication skill and work progress of the student, the project work should be reviewed at least once in a month by committee.
11. The final assessment of this course will be through a viva-voce by a committee comprising of industrialists and other departmental engineers.
