

**CURRICULUM**

**FOR**

**DIPLOMA IN**  
**TOOL & DIE MAKING**

**(3 YEARS)**



REVISED BY:

**BOARD OF TECHNICAL EDUCATION DELHI**

**(DELHI STATE)**

EFFECTIVE FROM: 2013-14

**Revised Syllabus of Tool & Die Making**

**Delhi Institute of Tool Engineering**

**Wazirpur Industrial Area**

**Delhi - 11052**

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

FIRST SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
1.1		Applied Mathematics -I	2	1	-	50	-	100	3	-	-	150
1.2		Applied Physics	2	0	2	50	50	100	3	50	3	250
1.3		Applied Chemistry	2	0	2	50	50	100	3	50	3	250
1.4		Communication Techniques	2	0	0	50	-	100	3	-	-	150
1.5		Engineering Drawing-I	1	0	4	50	50	100	3	-	-	200
1.6		Manufacturing Technology	2	0	2	50	50	100	3	50	3	250
		Total	11	1	28	300	200	600		150		1250

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

SECOND SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
2.2		Applied Mathematics - II	2	1	0	50		100	3	-		150
2.2		Engineering Drawing - II	2	0	10	50	50	100	3		6	200
2.3		Electrical Technology	2	0	2	50	50	100	3	50	3	250
2.4		Engineering Metrology	2	0	2	50	50	100	3	50	3	250
2.5		Production Technology - I	2	0	0	50	50	100	3	50	3	250
2.6		Production Technology - II	2		2	50	50	100	50	50	3	250
		Total	12	1	27	300	250	600		200		1350

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

THIRD SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
3.1		Material Technology	2	0	2	50	50	100	3	50	3	250
3.2		Strength of Material	2	0	2	50	50	100	3	50	3	250
3.3		Computer Application	2	0	2	50	50	100	3	50	3	250
3.4		Jigs & Fixture	2	0	2	50	50	100	3	50	3	250
3.5		Production Technology – III	2	1	08	50	50	100	3	50	3	250
3.6		Workshop Practice	0	1	12	-	50	-	-	100	3	150
		Total	10	2	28	250	800	500		350		1400

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

FOURTH SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
4.1		AUTO CAD Practice	2	0	4	50	50	-	3	50	3	150
4.2		Mould Theory - I	3	1	2	50	50	100	3	100	3	300
4.3		Press Tool Theory - I	2	0	4	50	50	100	3	100	3	300
4.4		Metal Forming Technology	2	0	2	50	50	100	3	50	6	250
4.5		CNC Technology	2	0	0	50	50	100	3	50	-	250
4.6		In Plant Training and Industrial Visit	10 week Training			-	50	-	-	100	-	150
		Total	11	1	12	250	300	400		450		1400

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

FIFTH SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
1.		Mould Theory – II	2	0	4	50	50	100	3	100	3	300
2.		Non Conventional Manufacturing Process	2	0	2	50	50	100	3	50	3	250
3.		Industrial Management –I	2	1	0	50	-	100	3	-	-	150
4.		Press Tool Theory – II	2	0	4	50	50	100	3	100	3	300
5.		Industrial Hydraulic and Pneumatic	2	0	2	50	50	100	3	50	3	250
6.		Minor Project - I	0	2	12		100			200	3	300
		Total	10	3	24	250	300	500		500		1550

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

SIX SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
6.1		Mould Design - I	2	1	4	50	50	100	3	100	3	300
6.2		Industrial Management - II	3	1	-	50	0	100	3		-	150
6.3		Forging & Die Casting	2	1	2	50	50	100	3	50	3	250
6.4		Press Tool Design	2	1	4	50	50	100	3	100	3	300
6.5		Minor Project - II	0	2	12	-	100	-	-	200	3	300
		Total	09	6	22	200	250	400		450		1300



FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

SEVENTH SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
7.1		Mould Design – II	2	0	4	50	50	100	6	100	3	300
7.2		Computer Integrated Manufacturing	2	0	2	50	50	100	6	50	3	250
7.3		Human Factors and Behavior	2	0	0	50		100	3			150
7.4		Major Project (Press Tool/Mould making - Exercise/Manufacturing /Design)	0	2	24		150		-	350	8	500
		<b>Total</b>	<b>6</b>	<b>2</b>	<b>30</b>	<b>150</b>	<b>250</b>	<b>300</b>		<b>500</b>		<b>1200</b>

FOUR YEAR DIPLOMA IN TOOL & DIE MAKING

STUDY AND EVALUATION SCHEME

EIGHTH SEMESTER

S No	Code No	Subject	Study Scheme Period/Week			Evaluation Scheme						Total Marks
			L	T	P	Internal Assessment		External Assessment Exam				
						Theory	Practical	Written Paper		Practical		
						Max Marks	Max Marks	Max Marks	Hrs	Max Marks	Hrs	
1.		Major Project Work & Viva (Inplant Training)		5	35		400			850	20	1250
		Total		5	35		400			850		1250

**SEMESTER - 1**

Semester I  
1.1 Applied Mathematics - I

DETAILED CONTENTS

1. **ALGEBRA** 15%
  - (i) Arithmetic Progression (A.P.) - its  $n^{\text{th}}$  term, sum to  $n$  terms. Geometric Progression (G.P.) - its  $n^{\text{th}}$  term, sum to  $n$  terms. And infinite Geometric series.
  - (ii) Partial Fractions.
  - (iii) Binomial theorem for positive integral index (without proof). Binomial theorem for any index, Expansions.
  
2. **TRIGONOMETRY.** 15%
  - (i) Sum and difference formulas for trigonometric ratios of angles and their application (without proof). Formulae from product to sum, difference and vice-versa. Ratio of multiple angles, sub multiple angles (like  $2A, 3A, A/2$ ).
  - (ii) In a triangle sine formulas, cosine formulas. Napier's analogy. Solution of triangle.
  - (iii) Simple problems on height and distance.
  - (iv) Plotting of curves  $y = f(x)$ ,  $f(x)$  being algebraic function (maximum upto third degree) or trigonometric functions (Sine, Cosine, Tangent).
  
3. **COORDINATE GEOMETRY.** 40%
  - (i) Equation of straight line in various standard forms. Intersection of two straight lines and angle between them. Concurrent lines, perpendicular distance formula.
  - (ii) General equation of a circle and its characteristics. Equation of a circle given center and radius, three point form and diametrical form.
  - (iii) Definition of a conic section, standard equation of a parabola equation of parabola given its focus and Directrix. Given the equation of parabola finding its focus axis, vertex, Directrix and latus section.
  - (iv) Ellipse and hyperbola (standard equation, without derivation) determining the equation of ellipse and hyperbola given the Directrix, focus and eccentricity. Given the equation of the ellipse and hyperbola finding the foci, Directrices, axes, latus-rectum, vertex and eccentricity.
  
4. **VECTOR ALGEBRA.** 10%
  - (i) Concept of a vector, Position vector of a point. Addition and subtraction of vectors.
  - (ii) Multiplication of a vector by a scalar product and vector product of two vectors. Application to problems on work done and moment (torque)

5.

**DETERMINANT AND MATRIX.**

20%

- (i) Definitions Evaluation of a determinant of order two and three. Minor and cofactors. Properties of determinants. Solving simultaneous equations by Cramer's rule.
- (ii) Concept of a matrix, definitions. Transpose of a matrix, Symmetric and Skew Symmetric matrix, Diagonal matrix. Unit matrix, Addition and Multiplication of matrices, Adjoint and Inverse of a matrix, solving simultaneous equations by matrix methods.

1

Semester I  
1.2 Applied Physics

Measurement

(10%)

(i) Units and Dimensions

Fundamental and derived units, SI units, dimensions of physical quantities, dimensional formula and dimensional equation, principles of homogeneity of dimensions and applications of homogeneity principle in:

1. Checking the correctness of physical equation.
2. Deriving relations among various physical quantities.
3. Conversion of numerical values of physical quantities from one system of units into other system.

(ii) Errors in measurement accuracy, estimation of percentage error in the result of measurement.

2. Waves

(20%)

Generation of waves by vibrating particles, progressive wave, equation of wave; energy transfer by particles and waves, superposition of waves and its applications to interference, beats and stationary waves (graphical); sound and light as wave - range of frequencies, wavelengths, velocities and their nature, electromagnetic spectrum Doppler effect.

3. Sound

(15%)

(i) Acoustics

Reflection, refraction and absorption of sound waves by materials; definition of pitch, loudness, quality and intensity of sound waves, units of intensity (bel and decibel); Echo and reverberation and reverberation time, control of reverberation time. Acoustic insulation (qualitative treatment only of reverberation).

(ii) Ultrasonic

Production of ultrasonic waves by magnetostriction and piezoelectric effect, detection and properties of ultrasonic; applications to drilling, cold welding, cleaning, flaw detection and exploration (sonar).

4. Light

Geometrical Optics:

(15%)

Defect in image formation, eyepieces construction and principles of preparation of telephoto and zoom lens, principle of optical projectors, optical principles of OHP and slide film projectors.

Wave Optics:

(15%)

Interference of light waves; Young's experiment; Newton's ring application of interference (Flatness testing measurement of small thickness), basic ideas about diffraction and polarization of light waves.

5. **Laser and its Applications** (10%)  
Laser principle, types of Lasers; detailed study of the He-Ne and Ruby lasers and their applications. Fluorescent tube; mercury arc light, xenon source, sodium lamp.
6. **Atomic Structure and Energy Levels** (10%)  
Bohr model of atomic structure; Energy levels, ionization and resonance potentials, Energy levels of conductors, insulators and semiconductors. Atomic and crystal structure of silicon and germanium, covalent bonds, effect of temperature on conductivity of germanium and silicon.
7. **Radioactivity and Detection of Radiations** (5%)  
Natural radioactivity; half-life; decay constant; mean life; radioactive transformation. Principles of nuclear fission and fusion; energy generation. Source of background radiations; health Hazards of radiations. Units of radiation.

#### LIST OF PRACTICALS

1. Use of Vernier calipers and micrometer for determination of diameter of a wire.
2. Study of interference of sound waves using Quincke's tube.
3. Study of resonance in air column and determination of velocity of sound in air.
4. To make a telescope by combination of suitable lenses and determine its magnifying power.
5. Measurement of small thickness by interference method (by Fresnel's Biprism method)
6. To make a compound microscope by suitable combination of lenses and determine its magnifying power.
7. To determine the wavelength of sodium light by Newton's ring method.
8. Setting an QHP lenses and mirrors for its best performance.
9. Determination of wavelength of various spectral lines of mercury lamp.
10. Measurement of illumination level of a white surface under natural daylight, incandescent light and fluorescent light.
11. To compare the intensity of illumination by Bunsen's photometer.
12. Study of diffraction of He-Ne laser beam by markings on a Vernier scale and determination of its wavelength.
13. To measure the first ionization potential of Hg using a diode.

Semester I  
1.3 Applied Chemistry

1. **Structure of Atom** (10%)  
Rutherford model of the structure of atom, Bohr's theory of H atom and equation deduced. Quantum numbers and their significance, De-Broglie equation and uncertainty principle. Electronic configuration of 1 to 30 elements.
2. **Periodic Properties of Elements** (10%)  
Periodic law, periodic table, periodicity in properties like atomic radii and volume, ionic radii, ionization energy and electron affinity. Division of elements into s.p.d. and f block.
3. **Chemical Bonds** (10%)  
Electrovalent, covalent and coordinate bond and their properties. Metallic bonding (electron cloud model) and properties (like texture, conductance, lustre, ductility and malleability). Orbital concept of covalence, hybridization (simple treatment).
4. **Fuel and their Classification** (10%)  
Definition, characteristics, Classification, into solid, liquid and gaseous fuel, Petroleum and brief idea of its refining into various fraction and their characteristics and uses.
5. **Water** (10%)  
Impurities in water, method of their removal, hardness of water, its types, causes and removal, Disadvantage of Hard water in boilers pH value and its determination by calorimetric method.
6. **Chemical equilibrium** Law of mass action, equilibrium constant expression, relation between  $K_p$  &  $K_c$ . Calculation of Equilibrium concentration and constant for dissociation of  $NH_3$ ,  $PCl_5$  and  $HI$ ; characteristics of equilibrium. (10%)
7. **Metals** (10%)  
Cast iron and its properties, effect of sulphur, silicon and phosphorous as impurities in cast iron. Elementary knowledge of heat treatment of steels-hardening, tempering, annealing, normalizing and case hardening.



8. Alloys (10%)  
Definition, classification and necessity for making alloys. Composition, properties and uses of following alloys: Brass, Bronze, Gun-metal and Duralumin. Effect of carbon, nickel, chromium, manganese on steel.
9. Corrosion (10%)  
Its meaning, theory of corrosion, prevention of corrosion by various methods using metallic and non-metallic coatings.
10. Plastics and Polymers (10%)  
Plastics-thermo-plastic and thermo setting. Introduction of Polythene, P.V.C., Nylon, synthetic rubber and phenol-formaldehyde resin. Their application in industry.

#### LIST OF PRACTICALS

1. To find the strength in grams per litre of the given solution of sodium hydroxide with the help of standard oxalic acid solution.
2. Find the strength in grams per litre of given sodium hydroxide solution with the help of standard sodium-carbonate solution and intermediate solution of an acid.
3. Determine the total alkalinity in ppm in the given sample of water using standard sulphuric acid.
4. To find the amount of chloride ions present in water using silver nitrate solution (potassium chromate as indicator)
5. Determine the type of alkalinity in ppm present in a given sample of  $H_2O$  using standard sulphuric acid.

Semester I

1.4 COMMUNICATION TECHNIQUES – 1

Prose Text Book

A prose text book of about 150 pages well illustrated containing roughly though not necessarily: Biographies of two engineers and scientists, biographies of two great men (one religious and one national leader), two literary short stories, two humorous short stories; one short story of the type of scientific fiction; one essay. The text book shall be officially prescribed shall also contain a list of administrative and technical terms (approx. 150 words).

1. Terminology

Common administrative and technical terms with their Hindi equivalents from prescribed list as given in the text book. Foreign students or those who do not know Hindi may be asked to explain the terms in English.

2. Grammar

A brief review of easy form of tenses (present, past and future along with their sub forms **Indefinite, continuous, perfect and perfect continuous**). Conversion of direct narration into indirect form of narration and vice versa (only simple sentences). Punctuation, articles, prepositions, voice, auxiliary (Be, have, do and modals)

3. Comprehension

A passage of 100 – 150 words may be set to test the comprehension skill of the student. Simple question to test the understanding of the contents and vocabulary may be set:

4. Essay

Preferably on scientific topic from the given outlines. The paper setter may be instructed to give a choice of attempting one out of three topics. The question paper shall provide the out lines. The essay will be of 250 to 300 words. The examiner may select three topics one from each of the following fields:

i. Science

ii. Technology and

iii. General

5. Practice of speaking in English language by Organizing :

- Paper reading contests
- Discussion sessions
- Conduct of seminars on current topics
- Declamation contests

Semester I  
1.5 ENGINEERING DRAWING - 1

L T P  
Pds/ week 1 0 4 -

1.1 Definition of drawing and its importance, introduction to drawing instruments such as drawing board, minidrafter, instrument box, French curves, circle master etc. standard sheet sizes, types of pencils and its pointing etc. Use and application of various line in drawing practice.

1.2 DRAWING EXERCISES: Instrumental and free hand lettering (alphabets and numeral), vertical and inclined at  $75^\circ$  in different standard sizes i.e. 3, 5, 8, 12 and 35 mm in the ratio of 7:4 different types of lines used in engineering drawing.

2.1 Necessity of dimensioning, methods and principle of dimensioning, reduced and enlarged scales and their applications.

2.2 DRAWING EXERCISES:- dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surface, holes equally spaced of P.C.D counterbored holes, cylindrical parts, narrow spaced and gaps, radius, etc. samples on reduced and enlarged scales.

3.1 Introduction to orthographic projections, 1st angle projection and third angle projection, projection of cone, prism etc.

3.2 Drawing exercises :- to draw three views of given objectives object, six views of a non-symmetrical object, practice of missing line and missing views. (at least 8 drawing exercises on the above mentioned subject)

4.1 Introduction to sections, importance and salient features of section. Conventions used in sectioning.

4.2 Drawing exercises :- full section, half section, partial section, broken section and offset section. Different conventions for materials in sections exercises on sectional views of different objects

5.1 Principles of drawing pictorial/ isometric views and IS standards for drawing isometric views

5.2 Drawing exercises :- given 2 or 3 orthographic projections draw isometric views minimum three exercises

## 1.6 Manufacturing Technology

L T P  
Pds/ week 2 0 10

Hand tools – hammers, files, centerpunches, scrapers, hacksaws, pliers, spanners, screw drivers

Drills – drills, counter sinkers, reamers, drill geometry,

Measuring Instruments – tapes, rulers, verniers, micrometers, depth gauges, height gauges, bevel protractors, try squares

Marking Tools – Scribes, surface gauges, dividers, angle plates surface plate

Threads – taps, dies, thread terms, IS standards

Drilling Machines – different types, work holding devices, speeds, feeds, coolants, safety

Bench Grinding – Machines, wheel dressers, safety

Shaping Machines – different types, main parts, controls, driving mechanism quick return motions

Cutting tools – tool geometry, roughing tools, finishing tools, grooving tools, side tools, bent tools, T-slot tools

Work holding devices – Machine vice, direct clamping

Cutting speeds and feeds – work piece material, tool material, design of machine using tables

Calculation of machining time – length of jobs, feed per stroke, cutting stroke speed, return stroke speed

Safety – Rules and Regulations

# SEMESTER - 2

Semester – 2

2.1 Applied Mathematics – II

1. **COMPLEX NUMBERS** (5%)
- (i) Euler's exponential form (modulus argument form)
  - (ii) Hyperbolic function, relation between hyperbolic and circular functions.
  - (iii) Phasor, addition of sinusoidal form. Phasor diagram of R-L, R-C, and L-R-C circuits.
2. **DIFFERENTIAL CALCULAS.** (40%)
- (i) Functions, concept of evaluation of following limits.  
 $\lim_{x \rightarrow 0} \frac{\sin x}{x}$ ,  $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a}$   
 $\lim_{x \rightarrow 0} (1+x)^x$ ,  $\lim_{x \rightarrow \infty} \frac{a^x - 1}{x}$
  - (ii) Differential coefficient. Its physical application. As rate measure. Geometric interpretation as slope of a curve. Differentiation from first prin of functions like  $x^n$ ,  $a^x$ ,  $\log x$ ,  $\sin x$ ,  $\cos x$  and  $\tan x$ . Differentiation of sum, product and quotient of functions.
  - (iii) Differentiation of Trigonometric and inverse Trigonometric functions. Differentiation of function of a function, Implicit functions, parametric functions, Logarithmic differentiation.
  - (iv) Application of differentiation in finding errors, Tangent and normal of curves. Maxima of functions.
3. **INTEGRAL CALCULAS.** (35%)
- (i) Integration as inverse operation of differentiation. Integral of standard functions. Integration by substitution, by parts and by partial fractions.
  - (ii) Evaluation of integral of rational and irrational functions of the form.  
 $\frac{dx}{ax^2 + bx + c}$   $\frac{dx}{ax^2 + bx + c}$

- (iii) Simple definite integrals. Reduction formulae. Evaluation of  $\int \sin^n x \, dx$ ,  $\int \cos^n x \, dx$ ,  $\int \sin^m x \cdot \cos^n x \, dx$ . (m, n positive integers)
- (iv) Applications of integration to finding area under a curve and axes, volume of solid of revolution of area about axes (simple problems). Mean value and R.M.S. value of a function.
- (v) Numerical integrations. Approximate evaluation of definite integral by Trapezoidal rule and by Simpson's rule (without proof).

4. PARTIAL DIFFERENTIATION. (10%)

- (i) First order and second order partial derivatives of functions of two variables.
- (ii) Euler's theorem on partial differentiation of homogeneous functions. Total differentiation.

5. SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS. (10%)

- (i) Order and degree of a differential equation. Solving first order first degree differential equation - variable separable form, Homogeneous form and linear differential equation.
  - (ii) Solving second order differential equation - complementary function, particular integral with functions of the form  $e^{kx}$ ,  $\sin ax$ ,  $\cos ax$ ,  $x^n$ , on the right hand side of the equation.
  - (iii) Applications to L-C-R electric circuits.
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Semester -2

2.2 ENGINEERING DRAWING - II

L T P  
Pds/ week 1 0 4

- 1 Nomenclature of threads, introduction to foundation bolts. Locking devices and keys.
  - a) Drawing exercises :- Conventional symbols for V and Square threads, left hand and right hand thread, External & Internal threads. Forms of metric thread, B.S.W thread, buttress thread, Acme thread and knuckle thread. Different Views of hexagonal and square head nuts and bolts and assembly of nut and bolt with washer Foundation bolts: Rag bolt, Lewis bolt, Hook bolt, T – headed bolt and square bolt, lock nut, castle nuts, pin nut, sawn, various types of key and cotters.
- 2 Importance of various joints e.g. knuckle joint, Gib and Cotter joint etc. Importance of coupling e.g. Flange coupling, flexible coupling etc.
  - a) Drawing exercises :- Knuckle joint, Gib and Cotter joint, Flange coupling, flexible coupling, Spigot and socket joint.
- 3 Importance to rivets, Various types of rivets , uses of rivets pope joints welded joints and their conventions.
- 4 Types of rivets, types of riveted joints (single riveted and double riveted lap joint, single riveted and double riveted butt joint)
- 5 Limits and fits as per IS 919 – 1963. Surface roughness symbols and their uses. Different types of bearing and their uses. Principles and utility of detail and assembly drawing of machine parts.
- 6 Different types of bearings (one exercise). Exercises from detail to assembly drawing. Exercise form assembly to detail drawing (minimum 5 exercises).



Semester – 2

2:3 ELECTRICAL TECHNOLOGY

L T P

Pds/ week 2 0 2

1. General Introduction and Safety measures  
Electrical safety measures, Importance of earthing, safety measures in a workshop.
2. Principles of Alternating Currents and A. C. Circuits.  
Difference between DC and AC, Production of A.C. ,advantages between D.C. and A. C. Concept of frequency, concept of phase and phase difference, concept of resistance, Inductance, capacitance, power, and power factor, Idea of power factor improvement by use of capacitors, voltage and current – relation, simple problems.
3. Transformer  
Principle of working of a transformer, E.M.E equation cooling of transformer.
4. Principle of D.C. and A.C. Motor  
D.C. Motors – Principles of working. -Different types of motors, their connections to the supply mains and their applications. Starters, care and maintenance A.C. motors types of Motors;
  - i. 3 phase induction motor principle of working various types of starting methods of 3 Phase motor, application of induction motors
  - ii. Single phase inductor, motor method of connecting to the supply, Applications.
5. Electrical Heating
  - i. Advantages of electrical heating
  - i. Simple description of various types of electric frequencies
  - ii. Heating Calculation
- iv. 6. Measuring Instrumenting  
Electrical quantities and instrumenting for their measurement. Connection diagram of ammeters, voltmeters, wattmeters and energy meter in circuits. Use of multimeters.
7. Basic Electronics  
Introduction to Electronic components, thermionic emission, Diodes, Characteristics of diode, diode and half wave rectifier, diode as full wave rectifier, triode, triodes as amplifiers, transistor, I.C. circuits  
An overview of applications of Electronics in different fields. Brief idea about passive components used in electronics; diodes, transistors; IC circuits and Amplifiers their application and specifications.
8. Simple electrical control circuits and motor control.

SEMESTER -- 2  
2.4 ENGINEERING METROLOGY

L T P  
PDS/ WEEK 2 0 2

1. ENGINEERING Metrology, Basic Standards of measurement as meter and yard, primary, secondary and territory standards, line and end standards of measurements.
2. Interchangeability system of limits and fits, hole basis and shaft basis system fundamental deviation and tolerances as per IS standards.
3. Inspection gauges, classification indicating types, fixed type gauges. Plain limit gauges such as plug, ring snap and thread gauges. Specifications and design considerations of plain limit gauges as per IS standards.
4. Linear, form and positional errors, Description and measurement of straightness, flatness, circularity, cylindricity, concentricity, coaxiality, ovality etc.
5. Sine bar, slip gauges, dial gauge and their application.
6. Surface finish characteristic, RMS and CLA values and measurement-visual, standard specimen, talysurf instrument.
7. Study and use of mechanical comparators, height master, profile projector, and tool-makers microscope.

PRACTICAL EXERCISES

1. Use of linear measuring instruments like vernier caliper and micrometer.
2. Use of height gauge and depth gauge.
3. Measurements with the help of combination set and bevel protractor.
4. Angle measurement by use of sine bar and slip gauges.
5. Use of slip gauges in measurement of centre distance between two pins
6. Use of comparator for measurement.
7. Measurement of taper by standard balls and rollers.
8. Measurement of thread parameters by using tool makers microscope.
9. Measurement of gear elements by using gear tooth vernier.
10. Measurement of profile by profile projector.
11. Measurement of surface roughness of a surface.

Semester II  
2.5 Production Technology – I

L T P  
Pds/ week 2 0 10

Lathe Machines – Types, main parts

Work holding devices- Chucks, collets, centers, face plates, mandrels, steady rests

Turning tools & tool geometry – HSS, carbide, diamond, ceramic, roughing tools, finishing tools, plain turning, facing, threading tools boring, profile, parting off.

Tool holders:- Holders for tool bit, tool post, clamping plate, four way tool post

Turning operations – Plain, steps, parting, boring, grooving, facing, threading, profile, drilling, tapping, reaming, counter boring

Taper turning methods – offset tail stock, taper turning, attachment, effect of tool position. taper calculations

Eccentric turning- Calculations, aids, inspection

Copy turning- equipment, hydraulic, mechanical, templates

Thread cutting- Gear setting, inch conversion, metric threads from inch lead screw, inch threads from metric lead screw, multi start threads, threading dial, right and left hand threads, external and internal threads

Thread terminology – Inch, metric, pitch, square profile, saw tooth, pipe threads

Cutting speed – Length in m/min, material of work piece, tool material, cross section of chips, cooling, design of machine

Calculation of R.P.M – Cutting speed, diameter of work piece, tables

Feeds & depth of cut - Material, cutting tools, cutting angles, feed in mm per revolution

Calculation of machining time – Setting time, machining time, auxiliary time, delay time, total time

Safety – Rules and Regulations

Semester II  
2.6 Production Technology - II

L T P  
Pds/ week 2 0 10

1. Milling machine – Different types, horizontal, vertical – universal, main – parts, control function, specifications.
  - 1.1. Milling cutters – tool geometry, fluted cutter, side and face, angular, double angle, slitting saws, form tools, gear cutters, end mills, shell end mills, slot drills, T- slot, face mills, carbide milling cutters.
  - 1.2. Holding devices for cutters – Arbor, collets, tapered shanks, "Clarkson" system, adapter
  - 1.3. Work holding devices – Machine vice, direct clamping, 3 – jaw chuck, 4 jaw chuck, milling fixtures, angle plates.
  - 1.4. Milling operations – Up milling, down milling, roughing, finishing, plan surfaces, key ways, slides, hexagons, profiles, cam milling
2. Boring – boring head, straight holes, counter bores
3. Dividing head & rotary table – handling, index plate, angular, direct indexing, simple, differential.
4. Gear Cutting Machines- Introduction for generation for Hobbing and shaping.
5. Slotting attachment – Internal grooves, key ways, design of attachment, length of stroke, slotting tools.
6. Speeds & feeds – Selection of R P M, cutting speed, diameter of cutter, nos. of teeth, work piece material, depth of cut, chip formation, machine power, surface finish, coolant.
7. Calculation of machining time – length of work piece, feed, R P M.
8. Safety – Rules and Regulations

# SEMESTER - 3

Semester - 3

### 3.1 MATERIAL TECHNOLOGY

L T P  
Pds/ week 2 0 2

Elements and their classification, Metals and non-metals, definition of metals, crystalline and non-crystalline structure, atomic structure grain growth. Unit cells common structure of metals (BCC, FCC, HCP). Elements, Compounds, Solid solution and its types

Ferrous and non-ferrous metals. Physical and mechanical properties of metals, Brief description of non-ferrous metals such as copper, Zinc, aluminum, tin, lead. Their common alloys, bearing and bearing materials

Iron and Iron ores, dressing and smelting of ores, Blast furnace, Manufacture of iron and steel by different methods, various commercial forms and iron and steel.

Cast iron and its definition, structure of cast iron. Type of cast iron malleable and nodular cast iron, properties of cast iron and common application.

Iron and plain carbon steel, different grades and composition of steel, common uses of different grades of steel.

Common alloying elements, purpose of alloying and their effects on the properties of steel. Powder metallurgy advantages, sintering and manufacturing the products, cutting tools materials such as carbides and ceramics.

Principles and descriptions of testing of metals. Mechanical properties and their method of testing such as tensile. Compression hardness, Impact, creep and fatigue test etc.

Solidification of iron, iron carbon equilibrium diagram, various constituent phases.

Advantages of equilibrium diagram, The S- Curve (TTT curve) and its specific application in the heat treatment of steel and phase transformations.

Heat Treatment and its purpose. Allotropic form of iron, different processes of heat treating steel such as annealing, normalizing, hardening and tempering

Special processes such as Aus-tempering and MAR tempering and their specific use. Heat treatment of iron, surface hardening by chemical and pack carburizing.

Special process of surface hardening such as flame hardening and Induction hardening, process of nitriding.

Cooling medium and their effects on the rate of cooling.

Heat treatment of alloys, steels such as High carbon, High Chromium. Heat treatment furnaces, Muffle Induction and salt bath furnaces.

Semester – 3

### 3.2 STRENGTH OF MATERIALS

L T P  
Pds/ week 2 1 2

Simple stress & strain – Introduction, elasticity, stress, strain, types of stress – tensile, compressive, shear, elastic limit, Hook's law, Young's modulus, working stress, factor of safety, stress, in composite bars, temp stresses.

Elastic constants – Poisson's ratio, bulk modulus, relation between elastic constants, problems

Strain energy & impact loading – Introduction, proof & modulus of resilience, strain & energy applied when load is applied, gradually, suddenly and with impact problems

Theory of simple bending – Bending stress, bending equation, neutral axis, simple problems on bending

Bending moment & shear force – Introduction, types of beams, cantilever and simple supported & overhanging, shear force & bending moment diagrams for different loads e.g. concentrated & uniformly distributed loads.

Moment – Definition, Law of moments, simple problems.

Centre of gravity & Movement of Inertia – Definition, CG of triangle, square, cylinder, circle, and semicircle etc. analytical and graphical methods.

Friction & transmission of power – Introduction, static & dynamic friction, limiting of friction, angle & coefficient of friction, simple problem, power transmission by belts, ropes & chains.

Torsion of shafts -- Definition, derivation, torsion equation.

Thin cylinders – Definition, stresses in a thin, cylinder, circumferential stress, longitudinal stress, simple problems. Thick cylinders.

Springs – close coiled helical springs.

Short column, bending & direct loads.

Long –columnne: Eulers & Ranking equation for buckling load.

Combined bending and Torsion effects.

Principal stresses and Principal strains.

Theories of failures.



Semester – 3  
3.3 Computer Application

L T P  
Pds/week 3 0 10

Evolution of computing machines-

- Computer Generation, Block diagram of a computer other view of its working.
- Era of a personal computing
- Digital computers , micro computers
- Input/output devices-interconnections of various peripherals with computer
- Auxiliary storage devices,
- Classification of programming languages
- Evolution of programming paradigm
- Fourth generation language(4GL)
- Application versus system program
- File organization, file types
- Classification of computer – SIMD, MISD, SISD, MIMD
- Basic of printing, scanning devices used in industries.

Familiarization with operating system

- Introduction to operating system as Dos, Window 95/98/2000/NT/XP and WNIX along with these comparisons.
- Introduction to DOS structure, system files, batch files @ configuration files.
- Booting the system from floppy & hard disk
- Brief instruction to DOS internal & external commands.
- Familiarization with windows, structures its use & application
- Introduction to client-server technology(basic)

Preparation of documents through word processing – Idea of text editors like Microsoft word, opening a document, creating shortcut, preparing documents in circuit diagram & tables.

Editorial documents – character, used & line editing, Margin setting, paragraph alignment, block operations, spell checker, saving & printing a document.

Information presentation for decision making using spread sheets(Excel/Lotus 1-2-3) : application of spreadsheets, structure of spreadsheet. Preparation of spread sheets for simple data & numeric operations using formula in spreadsheet operations, making tables sorting & querying, creation of graphs, pie-charts, bar charts, printing reports

Computer Aided Drafting : introduction & application of Auto CAD, geometric features, editing, layering, dimensioning, 3D solid modeling, rendering, plotting.

Web Technologies/Introduction to internet : what is internet? www.search engines, about internet addresses(Basic), equipment require for internet. For basic of audio & video conferencing.

Semester – 3

### 3.4 JIGS & FIXTURES

L T P  
Pds/ week 2 1 2

1. Jigs and fixtures
  - 1.1. Introduction to jigs and fixtures
  - 1.2. Importance and use of jigs and fixtures
  - 1.3. Principles of location
  - 1.4. Locating devices
  - 1.5. Purpose of clamping elements
  - 1.6. Types of clamps
  - 1.7. Types of drilling jigs, milling and welding fixtures (brief description)
2. Jig design
  - 2.1. Fundamentals of jig design
  - 2.2. Standard jig parts
  - 2.3. Types of materials used for manufacturing jig parts
  - 2.4. Manufacturing processes for jigs
  - 2.5. Design of various drilling jigs like plate jig, latch jig, pot jig.
3. Fixture design
  - 3.1. Principles of fixture design
  - 3.2. Standard fixture parts
  - 3.3. Type of material used for manufacturing fixture
  - 3.4. Processes used for manufacturing fixture parts
  - 3.5. Design of various types of fixtures like face milling fixture, string and gang milling fixtures, welding fixture

### **LIST OF PRACTICALS**

1. Fabrication of drilling jig,
2. Fabrication of milling fixture,
3. Fabrication of welding fixture
4. Grinding of a lathe tool on a pedestal grinder & a drill, a milling cutter and a reamer on a tool and cutter grinder

### **RECOMMENDED BOOKS**

1. "Tool Design" by Donaldson, ASTME
2. "Fundamental of Tool design" by FW Wilson : Prentice hall of India Pvt. Ltd., New Delhi
3. "Tool Engineering and Design" by GR Nagpal: Khanna Publishers, Nai sarak. New Delhi

Semester - 3  
3.5 Production Technology – III

L T P  
Pds/ week 2 0 8

1. Grinding machines – Surface, cylindrical, centreless, specification, machine parts
2. Grinding wheels – The abrasive, bonds, silicate, vitrified, shellac, grit and grade, structure, marking systems
3. Wheel selection – Material of work piece, surface finish, profiles, machine type, coolant.
4. Shapes of grinding – Straight cup, saucer, flange cup, cutting off, dish, wheels tapered, double cup
5. Wheel mounting – sound check , preparation of wheel, requirement to flanges, flange diameter, cardboard rubber, compressive washers, tightening of wheel on flange, safety.
6. Wheel balancing – Reason of balancing, methods, static, dynamic
7. Wheel dressing – purpose of dressing, types of dressers, diamond dressers, diamond carat, cooling, during dressing depth of cut, R P M of wheel, selection of dressing speed
8. Calculation of Feed & Speed – grinding operation, wheel structure , roughing, finishing , work piece material
9. Machining time – length of work piece, feed , revolutions, no. of cuts, grinding operations
10. Use of coolant – Purposes of cooling, requirements to coolant, types of coolant, filtering of coolant, types of filter systems.
11. Auxiliary equipment – Magnetic base, function of permanent, magnetic base, maintenance, function of electromagnet base, laminated blocks & applications, v – block, magnetic, magnetic vice, sine bar, sine table, precision vice , demagnetization.

12. Surface grinding operations – selection of wheel, cutting parameters, grinding into an right angle, grinding of thin, components, grinding of edges,
13. Cylindrical grinding operations – Selection of work holding devices, selection of wheel, guidelines for OD grinding, guidelines for plunge cut grinding, guidelines for ID grinding
14. Profile grinding Operations – applications, selection of wheels, machine for profile grinding, radius dresser, radius/ tangent dresser, pantograph dresser, full cut process, profile inspector.
15. Jig grinding operations – Machine & its construction , applications , OD grinding ,ID grinding
16. Tool & cutter Grinding operations – Machine & its construction, various spindles spindle head, tall stock, OD grinding , ID grinding, spiral grinding
17. Surface finishing operation – Honing, lapping and super finishing
18. Safety – Rules and Regulations.

SEMESTER – 3  
3.6 Workshop Practice

L T P  
Pds/ week 0 0 8

Introduction to fitting shop, common materials used in fitting shop, identification of materials. (e.g. Steel, Brass, Copper, Aluminium etc.) Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section, etc.

Description and demonstration of various types of work benches. Holding devices and files, Precautions while filing. Different types of punches and their uses

- Filing practice (Production of flat surfaces) Checking by straight edge.
- Marking of jobs, use of marking tools and measuring instruments.

Filing a dimensioned rectangular or Square piece of an accuracy of  $\pm 0.25\text{mm}$ .

Introduction to chipping, Demonstration on chipping and its applications. Demonstration and function of chipping tools. Chipping practice

Care and maintenance of measuring tools like callipers, steel rule, try square, vernier calipers, micrometer, height gauge, combination set, surface plate, universal angle-plate. Handling of measuring instruments, checking of zero error, finding of least count.

Preparation of a job by filing on non-ferrous metal upto an accuracy of  $\pm 0.1\text{mm}$

Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow, tee union, socket, stopcock, taps, etc.

Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade.

- Making a cutout from a square piece of MS.Flat using Hand hacksaw.

Description and demonstration of various types of drills, taps and dies Selection of dies for threading, selection of drills and taps for tapping operations.

- Drilling practice on soft metals (Aluminum, Brass and copper)
- Introduction and demonstration of dial type Indicator, sine bar and U block with clamps

Introduction to various types of threads (internal, external)-single start, multi-start, left hand and right hand threads.

- Making internal and external threads on a job by tapping and dieing operations manually), Precautions while drilling soft metals, e.g. copper, Brass, Aluminium etc.



SEMESTER - 4

Semester - 4  
4.1 AUTO CAD Practice

L T P  
Pds / week 0 0 2

**AutoCAD Fundamentals :** Concept of CAD, Starting AutoCAD, AutoCAD screen components, Using keyboard function key, activating keyboards, icon menus, Invoking commands in AutoCAD using the preference box, changing the colour of display, changing the size of cursor, using the units control box, calculating the limits of the drawing, limit setting for sheet size, Starting a drawing: Open drawings, Create drawings, saving a drawing, closing a drawing, Quitting AutoCAD.

**Introduction to CAD commands :** Tool bars in CAD, AutoCAD coordinate system - Absolute co-ordinate system, relative co-ordinate system, direct, , snap, grid, and ortho mode, Drawing commands - point, line, arc, circle, ellipse, Editing commands - scale, erase, copy, stretch, lengthen and explode. Dimensioning techniques and placing text in drawing area . Sectioning and hatching , Inquiry for different parameters of drawing entity .

**Geometric Construction :** Bisecting lines and arcs, bisecting angles, fillet and rounds, chamfers, dividing an object into parts, drawing parallel objects, constructing Hexagons, ellipse etc.

**Detail and Assembly drawing of the following using CAD :** Journal Bearing, Wall Bracket, Stepped pulley, V-belt pulley, Flanged coupling, Spur gear, Screw jack. . .

**Isometric Drawing:** Isometric basic, creating an isometric grid, isoplane mode, basic isometric construction, creating isometric section, exploded Isometric view, Isometric assemblies.

**Solid Modelling :** Introduction of 3D modeling, Wire frame and surface modeling, Transformations, scaling, rotation, translation, editing solid models, obtaining mass properties, cutting section from solid models, shading solid models.

**Plotting Drawings in AutoCAD :** PLOT command, Plot Configuration, Pen Assignments, Paper Size & Orientation Area, Plot Rotation & Origin, Plotting Area - Scale.

**Introduction to other CAD softwares :** Salient features of latest software like - Pro Engineer/CATIA /Unigraphics/Solid Edge/Ideas etc.

Semester – 4  
4.2 MOULD THEORY - I

L T P  
Pds / week 2 0 2

Introduction : Definitions , working principles

Construction : Parts function

Molding cycle : Injection Mould

Classification of molds : Types of Moulds

Two plate mould : Construction applications limitations.

Mold construction : Parts, function, core & cavity materials, material, specifications, heat treatment process

Filling systems : Sprue, runners, gates types, applications , advantages & disadvantages limitations, calculations.

Parting line : Flat, stepped, curved.

Ejection : Methods applications advantages.

Cooling : Water channels, diameters, water flow core and cavity cooling applications

Cam operation, splits, side cores : Methods, applications , finger cam , calculation of angles, & clearance, dog leg cam, delay period

Sprue pulling systems : types applications

Venting of mold : purpose position

Compression, hand, semi automatic & automatic molds - types, construction, applications, advantages & disadvantages

Transfer molds : Pot transfer, plunger transfer, construction, sprue, runners, gates.

Molding cycles : Cleaning, loading, closing, curing, ejection.

Heating of molds : Types of heaters, insulation plates, temperature, pre-heating.

Defects & remedies : Blistering, short shot, dull surface, internal voids, mould sticking, orange peel, clouded surface, warpage, cracks, burnt marks, thick flash.

Machine : Hand, mechanical, hydraulic, specifications, setting up, adjustments, safety, calculation of clamping pressure.

Semester - 4

### 4.3 PRESS TOOL THEORY - I

	L	T	P
Pds/week	2	0	

#### Press tools

Shearing theory and action : Principle of shearing action, three stages of shearing, cutting between punch and die, plastic deformation, edge radius cut band fractures blind burrs.

Cutting clearance : Importance of cutting clearance, identification of Components, effect on component of optimum Clearance, insufficient clearance, excessive clearance, Misalignment between punch and die, calculation of Clearance, relation between piece, part and punch size.

Blanking and piercing : Land and angular clearance, definition, punch Clearance, die clearance, dimensions of punches

Press working operations, Types of presses, Presses Fly press, foot press, power press, hydraulics Press capacity, classification, setting up, Adjustment, safety.

Presses Types and application, gap, frames press, Straight sided of our post presses, under Drive presses, super high speed press

Sources of power for presses : Manual, mechanical, hydraulics, pneumatics

Types of dies, Types die sets Die set Standard, day light and shut height, element of die Set material, manufacturing, types and application.

Punches and dies Tool steels used for Punches & Dies: Properties and effect of alloy elements, heat treatments, hardening and tempering, stress relieving.

#### Pads

Die/punch clearance and their calculations

Stripper plates

Stops, pilots, stock layout

Calculation of cutting forces, blank dimension

Design of blanking die, progressive die, compound die & cup drawing die

Material used for press tools and their heat.treatment, procedure for heat treatment of tools and dies respectively.

Semester - 4

#### 4.4 METAL FORMING TECHNOLOGY

L T P  
Pds / week 2 1 2

Introduction to various forming processes, Rolling, Forging, Drawing, extrusion, deep drawing & other sheet metal forming.

Forming properties of materials, Tensile Test curve, Determination of yield strength, Elastic- Plastic deformations, work done in elastic & plastic deformation. True stress and true strain curves, effect of temperature on yield strength, strain hardening strain rate effect. Recrystallization. Hot working & cold working, properties of product made by hot working and cold working yielding under multi axial stresses, Von - mises & Tresca's yield conditions, Metal flow in forging, die filling & die design.

Sheet metal forming, formability, drawability. Techniques for increasing drawability.

Friction and lubrication in forming processes like extrusion and wire drawing, extrusion dies, & wire drawing dies etc.

Semester -- IV

#### 4.5 CNC TECHNOLOGY

L T P  
Pds/ week 2 0 2

Basic of Conventional machine , Lathe, Milling, Grinding, drilling.

CNC Machines : Lathe , Milling, Grinding, EDM, Wire Cut EDM, their application, configuration and advantages over conventional machines, construction of ball screw.

CNC Tooling : Types of tooling's, tools holders, types of inserts, ball nose and bull nose cutter for Die & Moulds.

Work holding devices : Hydraulic & Pneumatics, Jigs & Fixtures, principle of working and their advantages.

Part Programming : programming languages application, different G-codes, M-Codes, absolute & Incremental programming.

Programming Cycles : contour milling, turning, , drilling, boring, reaming, tapping, thread milling, polar co-ordinates, mirror images, copying, macro's programming, tool length and radius compensation , ATC , APCL DNC introduction and their application.

SEMESTER - 5



SEMESTER-V  
5.1 MOULD THEORY-II

	L	T	P
Pds/ week	3	1	0

Three plate mould : Construction, application, advantages and disadvantages, Limitation.

Hot runner molding : Construction, application, advantages and disadvantages, Limitation.

Injection molding machine : Types of hand molding machine , plunger type ,screw type, Toggle , hydraulic, disadvantages , limitation , heating Cylinder, clamping system , setting up , adjustments , Safety.

Blow molding : Molding principle , mould construction , application

Thermoforming : Molding principle , mould construction , application

Centrifugal or Roto molding : Molding principle , mould construction , application

Extrusions : Molding principle ,construction of extrusion dies, application

Vacuum molding : Molding principle , construction of mould parts. Application

Defect and remedies In moulding : Flow marks , weld lines, burning , warpage, short shot

Polishing of moulds : Procedures, specific finish , parting lines , slots& runners.

Semester - 5

## 5.2 NON CONVENTIONAL MANUFACTURING PROCESSES

	L	T	P
Pds/ week	2	0	4

**Introduction :** Needs for Non conventional machining process, Classification of Non Conventional Machining Processes.

**Abrasive Jet Machining (AJM) :** Process, Operating Principles, Equipments, Material Removal Rate, Application,

**Ultrasonic Machining(UCM) :** Process, Working principle, selection of process, Material Removal Rate, Application, Limitations.

**Water Jet Machining(WJM) :** Process, Operating Principles, Mechanism of Jet cutting, Process parameter, Machining characteristics, Effect of Exit Pressure, Effects of Feed rate, Applications.

**Chemical Machining (CHM):** Process, Principle of operation, equipment, applications.

**Electrochemical Machining(ECM):** Process, Principle of operation, Equipment, Power supply and control, Dynamics of ECM process, Hydrodynamics of ECM Process, Applications.

**Electrical Discharge Machine(EDM):** Process, Operating principle, Dielectric Fluid, Electrode Material, equipment

**Wire Cut Electrodischarge Machine (WEDM):** Process parameter and their effects, Gap flushing.

**Laser beam Machining (LBM) :** Process, Lasing Material, Machining application of Laser.

**Electron Beam Machining(EBM) :** Introduction, Process Technology, Gun construction, Current control, Control of spot diameter, Control of Focal distance of magnetic lens, Current pulsing, Application.

**Plasma Arc Cutting (PAM) :** Process, operating principle, Plasma arc torch, parameter affecting cutting, advantage of plasma arc cutting.

**Ion Beam Machining(IBM):** Process, operating principle, Beam source, Ion guns, Ion beam setup, Sputtering rate(MRR), application, Advantages, Disadvantages.

Semester - 5

5.3 INDUSTRIAL MANAGEMENT - I

L T P

Pds / week 2 0 2

**Introduction of Industrial Management and Capital formation :** Introduction and scope, functions, the art of management, industrial systems, private partnership and private limited company, joint stock company, sources of capital shares, debentures, financial agencies and limited companies and their role.

**Human Relations :** Patterns of human behaviors, frustration, individual and group behavior, mob psychology, Grievances, labor turn over, job satisfaction

**Structure of Industrial Organization :** Line, staff and functional organization, functions of different departments , relationship between individual departments.

**Trade Unions :** Functions of trade Unions Collective bargaining. Pit falls in Trade union, major union in India , causes of industrial disputes, industrial disputes act.

**Labor and Industrial Laws :** Introduction of category act , workmen's compensation minimum wages act, employees state insurance act

**Wages and Incentives :** Definition of wage , real wage and nominal wage, systems of wage payment, incentive, Essentials of a good wage plan.

**Roll of Supervisor in Industry :** Supervisor as leader, position of supervisor in various engineering departments, foremanship- duties and qualities of a good foreman. Relations with subordinates, equal and superiors.

Semester V  
5.4 PRESS TOOL THEORY - II

Pds/week	L	T	P
	2	0	

**Introduction to tooling :** Basic description of press tools.

**Types of press tools :** Application of different types , blanking , piercing, Progressive , compound , combination , coining , Embossing , bending, drawing, flaring , curling, Bulging , swaging etc,

**Tool elements :** Main parts and their functions, to plate, Punch back pate, punch, stripper, plate, die plate , guide plate, bottom plate, pillar and bushes, Stoppers etc.

**Cutting and stripper force :** Calculation of cutting force, length of shear line, shear Strength, material thickness , calculation , shear angle On punch and die.

**Fine blanking :** Principle of process, application , construction of tool, Tool element , advantages, presses used for fine Blanking.

**Strip layout and Nomenclature :** Importance in tool design, percentage utilization of strip determining the most economical lay out , direction of Material grain , arrangement of punches, strip width , Multiple blanking,

**Construction of die :** Types of die , solid die, difference , basic design Requirement of die , factors for selecting splits dies.

**Mounting of punches :** By penning , by top screw, by cross pin , in araldite Advantages and disadvantages.

**Types of punches :** Plain punch , heeled punch .

**Methods of manufacturing of Punches and die :** Filing , conventional machining , grinding, wire EDM/ECM.

**Stripper plate :** function , types of stripper , solid stripper , floating Stripper , rubber stripper.

**Stoppers :** Functions , difference between strip position and Registering , position types, primary stopper, Secondary stopper, functions, finger stop , end stopper, Button, nest gauges , types of nest gauges.

**Pilot :** Functions , types and construction , direct , indirect, Bullet nose, lat arrows, spring loaded function , types Positioning of shank

**Centre of pressure** : Calculation , analytically , graphically.

**Progressive tools** : Selection criteria, application , construction . classification . blanking , piercing , close dimensions.

**Compound tools** : Selection criteria, applications , advantages , Disadvantages , construction.

**Ejection and shedders** : Functions of ejectors , functions of shedders , Direct and Indirect knock out.

**Shaving tool** : Comparison between compound and progressive Tool, function and application , construction , Dimension of punch and die ; allowance for Shaving.

**Lancing tool** : Comparison between , compound and progressive Tool , function . construction , dimensioning of Punch and die,, allowance for lancing.

**Trimming tool** : Comparison between , compound and progressive Tool , function , construction , dimensioning of Punch and die,, allowance for trimming.

**Bending tool** : Principal of bending , deformation process, during Bending, development , length , calculation, grain Direction , types , "V" bending , "U" bending , Calculation , application , calculation of bending Pressure, spring back , method of avoiding spring Back , method of stripping bending compound , effect of grain direction and effect of burr side.

**Classification of forming tools** : Functions , application , pressure pad forming , Curling, embossing ,construction , application , disadvantages.

**Combination tool** : Functions, application , construction elements , Blanking , drawing.

**Feeding mechanism** : Principles of systems , types , roller. Auto , pilots , die feed , double roller feed.

**Draw tools** : Functions , drawing operations , determining Blank size, variables which effects , the characteristics of metal flow, drawing force, calculation, construction element , working principle ,radius Of punch , clearance between punch and die, determining drawing pressure , drawing dies Single , double action.

**Deep drawing** : Principle , draw ratio, lubrication defects and Remedies.

SEMESTER – 5  
5.5 Industrial Hydraulic and Pneumatics

L T P  
Pds / week 2 0 2

**Fluid power systems:** Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. Transmission of power at static & dynamic states.

**PUMPS:** Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps.

**CONTROL OF FLUID POWER:** Necessity of pressure control directional control, flow control valves, Principle of pressure control valves, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve & methods of actuation of valves.

**FLOW CONTROL VALVES:** Principle of operation, pressure compensated, temp. compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits.

**DIRECTION CONTROL VALVES:** Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open-center, close center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc.

**ACTUATORS:** Linear actuator – construction and application of Single acting cylinder, double acting cylinder, cushioning mechanism. Rotary actuators – Types, vane, gear piston, radial piston motors.

**ACCUMULATORS & INTENSIFIERS:** Types & functions of accumulators, intensifiers, applications, selection.

**DESIGN OF HYDRAULIC CIRCUITS:** ISO symbols used in hydraulic circuits, Meter in meter out circuits, Pressure control for cylinders, speed control of forward and reverse stroke of cylinder, Circuit illustrating use of pressure reducing valves, sequencing valve, accumulators etc. Safety precautions of Hydraulic Circuits.

**Pneumatics systems :** Introduction, Advantages of Pneumatic system, Application of pneumatic systems, Basic Component of Pneumatic systems.

**Pneumatic power sources :** Air Compressors – working principle of single acting reciprocating air compressors & rotary compressors, axial flow air compressor, roots-blower etc.

Air preparation units, filters, regulators & lubricators. Actuators, linear, single & double acting, rotary actuators, air motors, pressure regulating valves, Directional control valves two way, three way & four way valves, solenoid operated, push button; & lever control valves. Flow control valves. Check valves methods of actuation, mechanical, pneumatic & electrical etc.

Pneumatic circuits for Industrial applications & automation, eg. Feeding, clamping, indexing, picking & placing etc.

**Text Books:**

- 1) Introduction to Fluid Power By Sahashtrabudhe, Nirali Prakashan Pune
- 2) Industrial Hydraulics By J.J. Pipenger, mcgraw Hill Co.
- 3) Pneumatics circuits By D.S. Mujumdar

**Reference Books:**

- 1) Pinches, "Industrial Fluid Power.", Prentice Hall
- 2) Vickers manuals on Industrial Hydraulics
- 3) H.L. Stewart, "Hydraulics & Pneumatics", Industrial Press
- 4) Yeaple, " Fluid Power Design Handbook".

**SEMESTER – 6**



Semester VI  
6.1 MOULD DESIGN - I

	L	T	P
Pds/ week	2	0	4

Design principle of injection moulds : Tabular moulding , stripper ejection, helical cooling , Two Plate mold design, construction and its parts, material, hardness.

Core and cavity : calculation of core and cavity dimensions, shrinkage of various Plastics , tolerance , draft , fit

Flat parting surface, edge gate , pin ejection, Multi cavity mould , blade ejection, submarine gate, Irregular parting line sleeve ejection. Different type of cooling.

Design Principles of compression moulds - construction of compression mold and its material , hardness, and its parts.

Flat parting surface , pin ejection , round inserts, Flat parting surface blade ejection, rectangular inserts. Irregular parting surface , Heating of mold.

Calculate for core and cavity : Dimensions, shrinkage , tolerance, draft, fit , loading well Dimensions.

Semester - VI  
6.2 INDUSTRIAL MANAGEMENT-II

	L	T	P
Pds/ week	3	1	0

Work Study : Element of work study , Brief description and method study . uses of work study in industry , work measurement, time study and allowances.

PPC : Functions of PPC, Routing , Scheduling, loading, dispatching and follow up, Process planning and its purpose, specification of detailed drawing and bill of material , planning the sequence, selection of machining tools, machining tools, machining load chart, Bar and GANTT charts, time standards.

Estimation and Costing :Estimation, Estimation cost, and standard cost, estimating procedure, estimation of material and labour cost, estimating tools cost, over heads and their allocation , Costing tooling and cost classification , basic cost structure of a product , distribution of costs , cost accounting.

Stores and purchases : Functions of stores, methods of storing , receipt and issue of items storing and ordering quantity , inventory control functions of purchase department , purchasing and purchase procedure.

Accounting and book keeping : Element of business transactions keeping system, journals ledger, accounting , cash book and balance-sheet.

Accident and safety : Classification causes of accidents, Industrial Hazards effects of accidents, accident prone worker , safety consciousness . safety measures , safety publicity.

SEMESTER-VI

6.3 Forging and DIE Casting.

	L	T	P
Pds/ week	3	1	0

**Introduction to Die casting process :** Gravity die-casting, pressure die casting, examples of the component, machines used, various casting processes, i.e. investment casting, centrifugal casting. Furnace and its types used for melting the metal.

**Die casting machines Classification & specification, parts and their functions, locking unit, injection unit, ejection unit.**

**Die casting dies :** Gravity die casting: main parts, top gating, side gating, bottom gating, risers, book type mould, rack and pinion mould, draft angle. Pressure die casting: Types, main parts- parting line, runner layout, gates, gating formula, location of gates, vents, core shrinkage, cooling methods, overflow, sprue, ejectors, ejector return mechanism, die lubricants and basic calculations, mould release agents.

**Introduction to Forging :** Various processes of forging, examples of components produced by forging processes, forging equipments and forging die features.

**Forging machines :** Types of machines, specification and various parts of machines, and their function.

**Forging dies :** Types of forging dies Closed die hammer forging, closed-die press forging, upsetting die forging, cold forging, open dies, extrusion dies, design of component drawing. Design consideration of forging tools such as fuller, edger, bender, blocker, finisher.

**Maintenance and storage :** Maintenance, safety and storage of forging die tools and material, handling of dies.

Semester VI  
6.4 PRESS TOOL DESIGN

	L	T	P
Pds/ week	2	0	4

Strip lay out : Basic rules, utilization of sheet material, required tonnage, Centre of pressure, graphically.

Die lay out : Dimensioning, calculation of thickness of die plate etc.

Design of Blanking tool : Calculation of size of tool elements, top view, front view, Side view, part list, detail drawings. Dimensioning, calculation of thickness of die plate.

Design of Progressive tool with die set : Finger stop, end stop (stage), Pitch punch, pitch punch and Spring, loaded strippers, cut off punch.

Design of Compound tool : Construction, top view, front view, side view.

Design of Combination tool : Dimensioning, calculation of thickness of die plate.

bending tool ( V Bending, U Bending, L - wiping Dies) : Dimensioning, calculation of thickness of die plate.

Draw tool : Dimensioning, calculation of thickness of die plate.

Semester VI

6.5 Minor Project -- II

**SEMESTER - 7**

Semester VII  
7.1 MOULD DESIGN-II

Pds/ week	L	T	P
	2	0	6

Core and cavity : Side core - finger cam, Side core - dog leg cam.

Design principles of Injection moulds : with components with undercuts side cores , side cores/ split arrangement, Flat parting surface, single cavity cup type.

Design principles of three Plate mould : construction of three plate mould, its parts material & hardness.

Latch type , tabular, multi cavity , with side cores , single cavity , multiple gate.

Design of blow mould : Construction of mould.

Semester VII

**7.2 Computer Integrated Manufacturing**

	<b>L</b>	<b>T</b>	<b>P</b>
<b>Pds/ week</b>	<b>3</b>	<b>1</b>	<b>0</b>

**CIM** : introduction , types of manufacturing, CIM hardware & CIM software, nature and role of the elements of CIM systems, benefits of CIM.

**Hardware Configuration** : motherboard, I/O Card, CD Rom Drive, workstation, Keyboard, mouse, digitizer.

**CNC Machines** : Types of CNC Machines, feature of CNC systems, DNC , Principal of operation, Specification of HMC, VMC, CNC Lathe.

**Part Programming** : Language of Part Programming, type of G code, M Code, use of CAM software in part programming.

**CNC Cutting tools & Holding devices** : types of cutting tools, types of inserts, specific tools for Dies & Molde, special holding devices for cutting tools, Modular tools.

**FMS & FMC** : introduction, need of FMs, subsystems of FMS applications, advantages and comparison to other systems, types of FMS.

**Robots** : introductions, types of robots, specification and its applications, advantages and disadvantages.

**Computer aided Production Management** : introduction , PPC fundamentals, problems with traditional PPC , application on the shop floor, computer based control plan.



SEMESTER-VII

7.3 HUMAN FACTORS AND BEHAVIOUR

	L	T	P
Pds/ week	3	1	0

Introduction to man machine systems ergonomics human factors In Engineering, Physiological aspects of work, work measurement through physiological cost , Paced and un Paced work on assembly lines. Design and selection of displays and controls, Application of body data to work place design, job design, Job rotation and work (Job ) Satisfaction. Working environment, cleanliness and industrial safety , accident prevention and safety management at shop floor.

Introduction to organizational structure and psychology, line and functional organization is and their application delegation of power.

Human relations:- group behavior and individual adjustment. Levels of communication theories of leadership . Motivation , reward management and productivity.

Democratization or decision making at various levels in an organization , worker participation in management decision making, concept of quality circles and their implementation.

**Semester VII**

**7.4 Major Project(Press Tool/Mould Making – Exercise/Manufacturing/Design)**

**SEMESTER – 8**

Semester VIII

Major Project Work & Viav(Inplant Training)