

MAHARASHTRA STATE BOARD OF VOCATIONAL EDUCATION EXAMINATION, MUMBAI - 51

1	Name of Course	Diploma Course in General Fitter cum Mehanic									
2	Course Code	303403									
3	Max no. of Students	25									
4	Duration	2 Year									
5	Course Type	Full Time									
6	No. of Days per week	6 days									
7	No. of hours per day	7 Hrs									
8	Space require	Theory Class Room – 200 sqft Three Practical Lab – 500 sqft each									
9	Entry qualification	S.S.C.									
10	Objective of syllabus	To get Knowledge of Engineering skill, use of fitters hand tools, measuring tools,. simple marking out according to simple Blue Print, filing /hack sawing and chipping, Drill holes, counter bores and spot face, Sharpen drill. Knowledge of plumbing assembly, Male simple jigs and fixtures, Dismantle and assemble simple machine parts and accessories, Repair broken gear tooth, To Understanding Engg. Drawing, To Prepare Drawing using CAD, Awareness of Safety precautions									
11	Employment opportunities	The student can get jobs with agencies which Produces machine parts or with working experience will be in a position to start his own independent Business.									
12	Teachers Qualification	1) For Vocational subject - B.E.Mech. 2) For Non Vocational Subject - Master Degree in Concern subject									
13	Teaching Scheme –										
	Sr.	Subject	Subject Code	Clock Hours / Week				Total			
				Theory	Practical						
	1	English (Communication Skill)	90000001	2 Hrs	1 Hrs			3 Hrs			
	2	Elective – I		2 Hrs	1 Hrs			3 Hrs			
	3	Elective – II		2 Hrs	1 Hrs			3 Hrs			
	4	Mechanical Technology and Material Science	30340001	3 Hrs	8 Hrs			11 Hrs			
	5	Machine Drawing and CAD	30340004	3 Hrs	8 Hrs			11 Hrs			
	6	General Fitting Technology	30340012	3 Hrs	8 Hrs			11 Hrs			
	Total							42 Hrs			
14	Internship	Two Months Summer Internship from 1 st May to 30 th June is Compulsory.									
15	Examination Scheme – Final Examination will be based on syllabus of both years.										
	Paper	Subject	Subject Code	Theory			Practical		Total		
				Duration	Max	Min	Duration	Max	Min	Max	Min
	1	English (Communication Skill)	90000001	3 Hrs	70	25	3 Hrs	30	15	100	40
	2	Elective – I		3 Hrs	70	25	3 Hrs	30	15	100	40
	3	Elective – II		3 Hrs	70	25	3 Hrs	30	15	100	40
	4	Mechanical Technology and Material Science	30340001	3 Hrs	100	35	3 Hrs	100	50	200	85
	5	Machine Drawing and CAD	30340004	3 Hrs	100	35	3 Hrs	100	50	200	85
	6	General Fitting Technology	30340012	3 Hrs	100	35	3 Hrs	100	50	200	85
										900	375
16	Teachers – Three Teachers per batch for vocational component. For English, Elective-I & II guest faculty on clock hour basis.										
17	a) For Elective I – Student can choose any one subject						b) For Elective II – Student can choose any one subject				
	Code	Subject Name				Code	Subject Name				
	90000011	Applied Mathematics				90000021	Applied Sciences (Physics & Chemistry)				
	90000012	Business Economics				90000022	Computer Application				
	90000013	Physical Biology (Botany & Zoology)				90000023	Business Mathematics				
	90000014	Entrepreneurship									
	90000015	Psychology									

Subject Name - **Mechanical Technology and Material Science**

Subject Code - **30340001**

Theory – 1st year	Practical – 1st year
1] Fundamental of material <input type="checkbox"/> Introduction of metals and non metals <input type="checkbox"/> Structure of metal <input type="checkbox"/> Formation of grain <input type="checkbox"/> Imperfection in crystals <input type="checkbox"/> Deformation in metal and change in properties <input type="checkbox"/> Fracture <input type="checkbox"/> Equilibrium diagram <input type="checkbox"/> Iron, carbon equilibrium diagram <input type="checkbox"/> Time temperature transformation diagrams	1. Take the tensile test of M.S. specimen & Draw stress strain diagram, yield pts.
2 Ferrous metals and alloys <input type="checkbox"/> Pig iron and cast iron <input type="checkbox"/> Effect of chemical elements on iron <input type="checkbox"/> Classification of steel and its application <input type="checkbox"/> Alloy steel and special alloy steel 3 Non Ferrous metals and alloys Introduction to non ferrous alloys <input type="checkbox"/> Aluminum and its alloys <input type="checkbox"/> Copper and its alloys <input type="checkbox"/> Lead and its alloys <input type="checkbox"/> Nickel and its alloys <input type="checkbox"/> Alloys for high temperature service <input type="checkbox"/> Metal for nuclear energy	2. Study the mechanical properties like Elasticity, ductility, malleability, Brittleness, toughness of Different materials – M.S., C.S. Bronze, Copper, Aluminum Study the Hardness test <input type="checkbox"/> Brinell Hardness test <input type="checkbox"/> Rockwell hardness test

4 Crystal Structures

- ☐ Fundamental concept
- ☐ Unit Cells
- ☐ Metallic crystal structures
- ☐ FCC Structure
- ☐ BCC Structure
- ☐ HCP Structure
- ☐ Weld ability

5 Properties of Metal

☐ **Mechanical properties of Metal**

Elasticity, ductility, malleability, brittleness, Toughness, Stress strain behavior, Elastic limit, hooks Law, UTS, poissons ratio, factor of safety, hardness and hardness tests shear strength, resistance.

☐ **Electrical properties of Metal**

Electrical conductivity, resistivity, electrical Characteristic of commercial alloys

Theory – 1 st year	Practical – 1 st year
<p><input type="checkbox"/> Thermal properties of metal</p> <p>Heat capacity, thermal expansion, thermal Conductivity, thermal stress</p> <p>6 <input type="checkbox"/> Magnetic Properties of metal</p> <p>Basic concepts, diamagnetism and Para magnetism, ferromagnetism, influence of temperature on magnetic behavior, domain and hysteresis, soft and hard magnetic material.</p> <p>7 Heat Treatment of material</p> <p><input type="checkbox"/> Normalizing</p> <p><input type="checkbox"/> Hardening</p> <p><input type="checkbox"/> Quenching and tempering</p> <p><input type="checkbox"/> Annealing</p> <p><input type="checkbox"/> Stress Relieving</p> <p><input type="checkbox"/> Case carburizing and case hardening.</p> <p><input type="checkbox"/> Toughening</p> <p>Weld ability of Metal definition and concept Effect of alloying elements on weld ability Purpose and types of weld ability tests</p>	<p>3. Study the Electrical Properties of some conductors (conductivity, Resistivity) Aluminum, Copper, Brass, Tungsten</p>
<p>8 Cracking phenomena in steel</p> <p><input type="checkbox"/> Cold crack due to hydrogen</p> <p><input type="checkbox"/> Hydrogen cracking</p> <p><input type="checkbox"/> Measurement and control of hydrogen in the deposited weld metal</p> <p><input type="checkbox"/> Cracking mechanism in the weld metal and HAZ</p> <p><input type="checkbox"/> Weld decay</p> <p><input type="checkbox"/> Lamellar tearing</p> <p><input type="checkbox"/> Hot cracking</p> <p><input type="checkbox"/> Reheat cracking</p>	<p>4. Study the effect on materials with heat treatment Normalizing, Hardening, Quenching & Tempering Annealing, Stress Relieving, Case Hardening, Toughening For Different Material's M.S., C.S., Nickel, Copper</p>

Theory – 2 nd year	Practical – 2 nd year
<p>1 Bench work and fitting</p> <p>Introduction- Vices – Hammers- Chisels-</p> <p>Chipping- Files- Filing- Scraper-Scraping- Grinding and Polishing- Hacksaw sawing- Marking tools – Surface plate- Scriber – Punch- V block- Angle plate- Try square – Marking out –</p> <p>Drill- Drilling- Reamer- Reaming- Taps- Tap drill size-Tapping – Dies and stock- Dieing.</p> <p>2 Sheet Metal Work</p> <p>Introduction – Metal used in sheet metal work-</p> <p>Sheet metal hand tools- Sheet metal operation-Sheet metal joint- Hems and Sems – Sheet metal allowance- Sheet Metal working machine-Laying out a pattern</p> <p>3 Plumbing, Threading, Fasteners & joints</p> <p>Plumbing- Specifications of pipes- Material used</p> <p>for pipes-Pipe fitting & Joints-Taps & valves – Plumber tools – Threaded fasteners- screw threads and their uses- Indian standard</p> <p>threads-Cap screw and machine screw-Set screw- Methods of producing screw threads- Bolts- Studs- Forms of nuts- Riveting joints.</p> <p>4 Smithy and Forging</p> <p>Maintenance and application of smith health- Anvil- Swage block-Tongs-Hammer-Flatters- Measuring tools e.g.-Try square- Steel rules- Calipers-Operations e.g. up setting- drawing down- bending setting- forge welding.</p> <p>5 Welding Technology</p> <p>Welding Welding introduction to different</p>	<p>Fitting</p> <p>1. Filing Flat surfaces:</p> <p>Checking flatness and square ness using a try square –</p> <p>Types of filing – Cleaning files.</p> <p>2. Chipping: Hints on chipping</p> <p>3. Hack sawing: Selection of blades for different metal sections - Fix hack</p> <p>sawing the material for the job blades maintaining. Correct tension and</p> <p>direction – Hack sawing. Filing ‘V groove and complex profile by file &</p> <p>check with profile gauge.</p> <p>4. Filing radius –check with radius gauge</p> <p>5. Check profile with profile gauges.</p> <p>6. Drill plate, Drilling, counter sinking, counter boring. Operations on job</p> <p>7. Drilling and Tapping: Internal threading of holes by using hand taps –</p> <p>determine the tap drill size, drilling, counter-sinking and tapping –</p> <p>precautions with tapping a blind hole.</p> <p>8. External thread cutting using die.</p>

<p>welding processes, like gas Welding, ARC welding TIG, MIG, submerged arc welding, spot Welding, electrodes etc. Brazing methods & application, Knowledge of welding skills.</p> <p>6 Metal Turning (Lathe)</p> <p>6.1 Function of lathe, Types of lathe, the size of lathe, Descriptions & function of lathe parts,</p> <p>6.2 Lathe accessories and attachments.</p> <p>6.3 Operation on Lathe</p> <p>6.4 Cutting Tools, Classification , Influence of tool angles.</p> <p>6.5 Types of tools, cutting speed, Feed, Depth of cut,</p> <p>6.6 Machining time. Cutting tool signature.</p>	
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Theory – 2 nd year	Practical – 2 nd year
<p>7 DRILLING</p> <p>Introduction Types of drilling machine, Portable drilling machine, Sensitive drilling machine. Upright drilling machine, Radial Drilling Machine; Gang drilling machine, Multiple spindle drilling machine Automatic drilling machine, Deep hole drilling machine; The size of a drilling machine, Upright drilling machine parts. Radial drilling machine parts, Work holding devices, Tool holding devices, Drilling machine operation, Drilling machine tools.</p> <p>Twist drill nomenclature. Drill size Designation of drill material Reamer, reamer nomenclatures. Counter bore, Countersinks and spot face, Taps. Tap nomenclatures. Cutting speed Feed, Depth of cut, Machining time in drilling</p>	<p>Basic Workshop Practice</p> <p>1. Step turning and Radius forming: Free hand form turning – by using form tool.</p> <p>2. Drilling and Boring-Use of inside caliper and outside Micrometer for bore measurement.</p> <p>3. Drilling and reaming: by hand-Method of checking the bore With a plug gauge.</p> <p>4. Drilling and step Boring: Boring blind hole with a boring tool.</p>
<p>8 SHAPER</p> <p>Introduction. Types of shapers. Principal parts. Shaper size; Shaper mechanism; Work holding devices. Shaper operations. Shaper tools; Cutting speed, feed and depth of cut; Machining time.</p> <p>9 SLOTTING</p> <p>Introduction. Types of slotting machine; Slotter size; Slotting machine parts; Work holding devices; Slotter operation; Slotter tools; Cutting speed, feed and depth of cut.</p>	<p>5. Drilling, Boring and Recessing: Internal recessing to a size broader than the width tool – Form a recess.</p> <p>6. Shaping blind & open keyways on shaping machine</p> <p>7. Shaping irregular surfaces.(Concave / Convex)</p>
<p>Powder Metallurgy</p> <p>Introduction- Process Description- Manufacture of metal powder- Blending of powders- competing profiteering- Sintering- Secondary operation –ISO Static pressing – Product of</p> <p>powder metallurgy-Advantages of process – Disadvantages and limitation-Design considerations Introduction to CNC</p>	<p>8. Slotting internal grooves on slotting machine</p> <p>9. Welding Practical-fusion run with/without filler rod on MS Sheet – squire butt joint on MS sheet LAP,T& Edge joint on M.S. Sheet</p>

List of Books

- 1 M. N. Uppal A Text - book of engineering Chemistry
- 2 V. P. Mehta A Text - book of polytechnic Chemistry
- 3 Banswal, Mahajan and Mehta A Text - book of, Applied Chemistry
- 4 Hazra Choudhary Elements, of workshop technology
- 5 S.K.Hajra Choudhary Elements of workshop technology Vol-I First 1964 Media promoters & Publisher pvt. Ltd.
- 6 Mahajan Mechanical Technology Third 1989 Vrinda publication

Sr. No. Name of the equipment/ machinery NOS.

1	TRAINEES TOOL KIT	5
2	Try Square 10 cm Blade	5
3	Calipers outside 15 cm spring	5
4	Caliper inside 15 cm spring	5
5	Dividers 15 cm Spring	5
6	Calipers 15 cm Hermaphrodite	5
7	Scriber 15 cm	5
8	Punch center 10 cm	5
9	Screw driver 15 cm	5
10	Chisel cold 20 cm	5
11	Trammel 30 cm	5
12	Hammer ball peen 0.5 kg with handle	5
13	Hammer Mallet	5
14	Hammer Plastic	5
15	Hammer ball peen 0.5 kg with handle	5
16	File flat 25 cm second cut	5
17	File flat 25 cm second cut	5
18	Hacksaw frame adjustable 20-30 cm	5
19	Dot slot punch	5

20	Steel rule 15 cm English and metric	5
21	Steel rule 30 cm English and metric	5
22	Try square 20 cm Blade	5
23	Steel tool box	5
24	Scriber	5
25	Lock and keys	5
26	Combination plier	5
27	Jenny calipers	5
28	Aluminum tray 15 cm X 10 cm	5
29	Fellow polish cloth standard size	5

	SHOP OUTFIT & MEASURING INSTRUMENTS	
30	Straight edge 45 cm X 45 cm	1
31	Marking table 90X90 cm	1
32	Surface plate 45 cm X 45 cm	1
33	Vee Block pair 7 cm and 15 cm with clamps	1
34	Angle plate 10 X 20cm	1
35	Number Punch 3 mm set	2
36	letter Punch 3 mm set	2
37	Round punch 3 mm X 4 mm set of 2	2
38	File flat 20 cm bastard	2
39	Oil Stone 15 X 5 cm X 2.5 cm	
40	Spanner adjustable 10 cm	1
41	Chisel cold 20 cm cross cut	2
42	Chisel 10 cm flat	2
43	Drill twist 1.5 mm to 15mm (various sizes) by 0.5	2
44	Files assorted sizes and type including safe edge	10
45	Micrometer inside 50-150 mm with screen	2
46	Bench Vice 12 cm jaw	5
47	Work Bench 240 X 120 60 mm with screen	3
48	Drill point angle gauge	1
49	Vernier Calipers 20 cm	2
50	Vernier height gauge 30 cm	1
51	Huntington and diamond dresser	1
52	Taps and dies complete set (metric)	2 set
53	Hacksaw frame	5
54	Fire buckets with stand	1
55	Thread pitch gauge metric, BSX, BSF, MC, MF & SAE	1 each
56	D.E. spanner ser of 12 metric 6 mm to 32 mm	1 set
57	Ring spanner set at 12 metric 6 mm to 32	1 set

58	Stud extractor set of 3	1 set
59	Universal puller for removing pulleys, bearings	1 set
60	Unserviceable engine/gear box rear axle	1
61	Stud remover with socket handle	1
62	Combination pliers 15 cm	5
63	Depth guage (inch and metric	1
64	Screw pinch gauge (inch and metric)	1 set
65	Feeler gauge 20 blades (inch and metric)	1
66	Aluminum tray 45 X 30 mm	5
67	Oil can 0.5 liter capacity	1
68	Surface gauge	1
69	Cylinder bore gauge (mercer)	1
70	Telescopic gauge	1
71	Steel measuring tape 10 meter in a case	2
72	Sets of Morse socket MT 0-1,1-2,and 2-3	1 set
73	Blow lamp	1
74	Torque wrenches 5-35 Nm,12-68 Nm&50-225 Nm.	1 each
75	Outside micrometer English 0-1,1-2,2-3,3-4,4-5,And 5-6 inches	1 each
76	Micrometer outside 1 to 25 mm,25mmto 50mm ,50 to75 mm,75 to100mm,100 to 125mm,125 to 150mm.	1
77	Surface gauge with dial test indicator plunger type i.e. 0.01 mm	1
78	Printed wall chart framed for display showing measuring instruments.	10
79	Inside micrometer English 2" to 6" with extension road	1
80	Vernier bevel protractor (metric and inch)	1
81	Vernier calipers (inch and metric) 6"x12"	1
82	Vernier micrometers(inch and metric)	1
83	Vernier height gauge 150 mm height (inch and metric)	1
84	Dial micrometer (inch and metric)	1
85	Small bore gauge (standard)	1
86	Dial test indicator to read (inch an metric)0.02mm	1

	GENERAL INSTALLATION /MACHINERIES	
87	Radial Drilling Machine 25mm capacity	1
88	Power Hacksaw	1
89	Rotary Cut off Machine	1
90	Shaping machine	1
91	Hydraulic Press 2 ton capacity	1
92	Surface plate (small)	1
93	Surface plate (big)	1
94	Standard Arc Welding machine	1
95	Horizontal milling machine	1
96	Bench Drilling machine 6-12mm cap Motorized with chuck and key	1
97	Grinding machine (general purpose)D.E. pedestal with 300mm dia wheels rough and smooth	1
98	Hydraulic Trainer with Power pack	1
99	Pneumatic Trainer	1
	Workshop furniture	
100	Suitable Work Tables with vices As required	1
101	Stools 25 Nos	25
102	Tool Cabinet 2 nos	2
103	Trainees locker 2 nos	2
104	Fire fighting equipment , first aid box etc As required	1
105	Book shelf (glass panel) 1 nos	1
106	Storage Rack As required	2
107	Storage shelf As required	2

Subject Name - Machine Drawing and CAD

Subject Code - 30340004

Theory – 1 st year	Practical – 1 st year
1 INTRODUCTION OF DRAWING Use of different drawing instruments, equipments & Drafting Techniques, Types of letters, conventions of line, Scales; plane scale and diagonal scales. 2 CURVES & TANGENTIAL EXERCISES To draw an ellipse by 1. Arcs of circle method 2. Concentric circle Method 3. Rectangle / oblong method; To draw a parabola by 1. Director focus method 2. Rectangle method; To draw hyperbola 1. Transverse axis and focus Method 2. Passing Through a given point; To draw an Involute of 1. A polygon (up to Hexagon) 2. A circle. To draw a cycloid, epicycloid & hypocycloid. 3 ORTHOGRAPHIC PROJECTIONS Introduction to orthographic projections, first and third angle Method of projection, conversion of simple pictorial view into Orthographic view Dimensioning technique 4 SECTIONAL VIEWS	PRACTICAL 1. Practice: Layout of drawing sheet Types of lines – Thickness, shade of lines and its General applications. Practice: Draw type of lines as per IS-70714-1983 Type of Angle, Triangles and their types. Dimensioning- Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement and indication of dimensions. Place dimensions in the drawing by aligned system and unidirectional system, Give dimension to the given drawing by following dimensioning principles as per BIS Method of dimension common features Geometrical construction using drawing instruments-Lines, Angles, patterns, Circle, Arc, Tangents, Triangles, Quadrilaterals, Regular Polygons. Different type of Tapers, Related Exercise on this topic. 1. Practice: Construct square, rectangle, parallelogram, rhombus, trapezium and quadrilateral 2. Practice: Draw a regular pentagon by circumscribing & inscribing 3. Practice: Draw a regular hexagon by arc method 4. Practice: Draw a regular pentagon, octagon and various types of tapers 5. Free hand sketching of straight lines, rectangular, circles, squares, Polygons, ellipse. 6. Practice: Prepare proportionate free hand

<p>Conversion of given pictorial view into sectional orthographic views.</p> <p>5 ORTHOGRAPHIC VIEWS</p> <p>Isometric scale and views of simple objects; isometric views of Rectangular, cylindrical objects and Representations of slots on Sloping faces.</p> <p>6 PROJECTIONS OF LINES</p> <p>Projections of solids- prism, prism, cone, cylinder, Tetrahedron; axis Inclined to one reference plane only.</p> <p>7 SECTION OF SOLIDS</p> <p>Sections of the solids-prism, pyramid, cone, cylinder, Solids resting on their bases on the Ground Section plane is inclined to one Reference plane and perpendicular to other</p>	<p>sketches of plane figures</p> <p>7. Practice: Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand</p> <p>Orthographic projection I and III angle – Simple machine elements, Procedure for preparing a scale drawing.</p> <p>8. Practice: Draw a plan, elevation and side view of prism and cylinder, cone and pyramids</p> <p>9. Practice: Draw 1st angle and 3rd angle projection (i) Front View (ii) Top view and (iii) side view of object having stepped blocks with curved surfaces – simple machine elements. Drawing Isometric views out of orthographic views – Simple Machine Elements</p> <p>10. Practice: Construct an isometric scales to a given length</p>
<p>8 CONVENTIONAL REPRESENTATION</p> <p>Introduction; Conventional Representation of Material; Conventional breaks, Machine components such as splinted shaft; bearings, slotted heads, raced & pinion, Internal & External Threading, Springs, Gears, Pipe fitting & pipe joint, Welded joint; Practice Drawing of all type of Conventions in the sketch book.</p> <p>9 LIMIT FITS & TOLERANCES</p> <p>Process Tolerance, Machining symbol, Induction of machining Symbol, Indication of surface roughness characteristics, symbol for direction of lay; Induction of machine allowance, position of Specification of surface roughness, Indication of drawing, Introduction of dimensional; Tolerances Element of</p>	<p>11. Practice: Draw the isometric projection of cube, hexagonal prism, cylinder and cone</p> <p>12. Practice: Draw the isometric view of the objects/blocks/solids with curved surfaces</p> <p>Missing lines and views.</p> <p>13. Practice: Visualize the shape of the object from the given two views and add the third views – simple machine elements</p> <p>14. Practice: Identify the lines missed in multi views and supply them. Identify at least five shapes satisfying a given view.</p> <p>One problem on each projection of lines and plane are to be drawn in A-3 size sketch book.</p>

<p>Interchangeable system, Tolerance; Fundamental tolerance, Calculation of limit size, Method of specifying dimensions of fit, limit & Tolerance, Geometrical Tolerance, form tolerance, Position Tolerance, Indication of Geometrical Tolerance; types of geometrical Tolerance.</p>	<p>15. Identify the third view for the given two views of similar in shapes and size.</p> <p>Development of regular objects bounded by plane surfaces-cube, prisms, cylinder and cones.</p> <p>16. Practice: Draw the development of surfaces of a cube and prism</p> <p>17. Practice: Draw the development of surfaces of a cylinder and cones Explanations of full – sectional view, half-sectional view, aligned sections.</p>
<p>10</p> <p>PRODUCTION DRAWING</p> <p>Introduction, need, scope; Production drawing procedure,</p> <p>Production drawing for, Nut & Bolt, Spur gear, Fly – cotter joint Wheel, V belt pulley.</p>	<p>18. Practice: Draw full and half sectional view of simple machine elements. Conventions and symbols used in drawing, Abbreviations used in engineering drawing, surface finish symbols, Welding symbols and Annotations.</p> <p>19. Practice: Draw surface finish symbols, Welding symbols and Annotations. Machining symbol, Induction of machining Symbol, Indication of surface roughness characteristics,</p> <p>symbol for direction of lay; Induction of machine allowance, position of Specification of</p> <p>surface roughness, Indication of drawing, Blue print reading of various Engineering drawing and Machine drawing.</p> <p>20. Practice: Blue print reading of Engineering Drawings and Machine drawing.</p> <p>Introduction to free hand sketching of machine parts. Tracing and printing of drawing.</p> <p>Introduction to Auto CAD, 3D modeling concept.</p> <p>21. Practice: Draw the elevation, plan and the side view of Nut & Bolt, Spur gear, and Fly cotter joint Wheel, V belt pulley.</p>

Machine Drawing and CAD – 2nd Year

Theory	Practical
A] Computer Fundamental	
1] Fundamentals Of Computer Introduction Components of PC The system Unit Front part of system Unit Back part of system Unit CPU Memory of computer Monitor Mouse, Keyboard Disk, Printer, Scanner, Modem, Video, Sound cards, Speakers	List of Practical 1. Working with Windows 2000 desktop ,start icon, taskbar, Recycle Bin, My Computer icon ,The Recycle Bin and deleted files Creating shortcuts on the desktop 2. The Windows 2000 accessories, WordPad – editing an existing document, Use of Paint – drawing tools The Calculator, Clock 3. The Windows Explorer window, concept of drives, folders and files? Folder selection techniques, Switching drives, Folder creation, Moving or copying files, Renaming, Deleting files ,and folders 4. Printing, Installing a printer driver, Setting up a printer, Default and installed printers, Controlling print queues, Viewing installed fonts, The clipboard and 'drag and drop', Basic clipboard concepts Linking vs. embedding,
2] Introduction To Windows 2000/Xp Working with window Desktop Components of window Menu bar option Starting window Getting familiar with desktop Moving from one window to another Reverting windows to its previous size Opening task bar buttons into a windows Creating shortcut of program Quitting windows	5. Moving through a Word document menu bar and drop down menus toolbars 6. Entering text into a Word 2000 document, selection techniques Deleting text 7. Font formatting keyboard shortcuts 8. Paragraph formatting Bullets and numbering 9. Page formatting What is page formatting? Page margins Page size and orientation Page breaks, Headers and footers 10. Introducing tables and columns
3] GUI Based Editing, Spreadsheets, Tables & Presentation Application Using MS Office 2000 & Open Office.Org Menus Opening, menus, Toolbars, standard toolbars, formatting toolbars & closing Quitting Document , Editing & designing your document Spreadsheets Working & Manipulating data with Excel Changing the layout Working with simple graphs Presentation Working With PowerPoint and	11. Printing within Word 2000 Print setup Printing options Print preview 12. Development of application using mail merge Mail merging addresses for envelopes Printing an addressed envelope and letter 13. Creating and using macros in a document 14. Creating and opening workbooks Entering data 15. Navigating in the worksheet Selecting items within Excel 2000 Inserting and deleting cells, rows

Presentation	and column Moving between worksheets, saving worksheet, workbook
4] Introduction To Internet What is Internet Equipment Required for Internet connection Sending &receiving Emails Browsing the WWW Creating own Email Account Internet chatting	16. Formatting and customizing data 17. Formulas, functions and named ranges 18. Creating, manipulating & changing the chart type 19. Printing, Page setup, Margins Sheet printing options, Printing a worksheet 20. * Preparing presentations with Microsoft Power Point. Slides and presentations, Opening an existing presentation , Saving a presentation
5] Usage of Computer System in various Domains Computer application in Offices, books publication data analysis ,accounting , investment, inventory control, graphics, database management, Instrumentation, Airline and railway ticket reservation, robotics, artificial intelligence, military, banks, design and research work, real-time, point of sale terminals, financial transaction terminals.	21. Using the AutoContent wizard ,Starting the AutoContent wizard, Selecting a presentation type within the AutoContent wizard Presentation type Presentation titles, footers and slide number 22. Creating a simple text slide, Selecting a slide layout Manipulating slide information within normal and outline view, Formatting and proofing text, Pictures and backgrounds, drawing toolbar, AutoShapes, Using clipart, Selecting objects, Grouping and un-grouping objects, The format painter

Machine Drawing and CAD – 2nd Year

Theory	Practical
	<p>23. Creating and running a slide show, Navigating through a slide show, Slide show transitions, Slide show timings. Animation effects</p> <p>24. Microsoft Internet Explorer 5 & the Internet</p> <p>Connecting to the Internet The Internet Explorer program window, The on-line web tutorial Using hyper links, Responding to an email link on a web page</p> <p>25. Searching the Internet, Searching the web via Microsoft Internet Explorer, Searching the Internet using Web Crawler, Searching the Internet using Yahoo, Commonly used search engines</p>
<p>6] Information technology for benefits of community</p> <p>Impact of computer on society</p> <p>Social responsibilities</p> <p>Applications of IT</p> <p>Impact of IT</p> <p>Ethics and information technology</p> <p>Future with information technology</p>	<p>26. Favorites, security & customizing Explorer Organizing Favorite web sites Customizing options – general, security, contents, connection, programs, advanced</p> <p>27. * Using the Address Book Adding a new contact</p> <p>Creating a mailing group, Addressing a message, Finding an e-mail address</p> <p>28. Using electronic mail, Starting Outlook Express</p> <p>Using the Outlook Express window, Changing the window layout, Reading file attachment, Taking action on message-deleting, forwarding, replying</p> <p>29. Email & newsgroups, Creating and sending emails</p> <p>Attached files, Receiving emails, Locating and subscribing to newsgroups, Posting a message to a newsgroup</p> <p>30. Chatting on internet, Understating Microsoft chat environment, Chat toolbar</p>
<p>Minimum system requirement for AutoCAD</p> <p>Starting AutoCAD – Use a Wizard, Use a Template, Start from Scratch, Open a Drawing, Quick Setup method, Advanced Setup method, Types of Units, AutoCAD Window Details – Menus, Toolbars, Command line area, Drawing area, WCS icon etc, Use of Function keys,</p> <p>Modes in AutoCAD – Snap, Grid, Ortho, Osnap, Polar, Otrack, Model</p> <p>Using various Toolbars, Creating new drawing, Saving a drawing, Closing a drawing, Opening a drawing, Use of</p>	<p>Practical related Creating New file, Closing Drawing, Saving Drawing, Startup Methods, Modes in AutoCAD,</p> <p>Use of Function Keys, Use of Keyboard and Mouse in AutoCAD Practice.</p> <p>CAD Command Practice on small objects</p>

<p>mouse in AutoCAD, Use of Keyboard,</p> <p>Coordinate system – Types of Coordinate, Absolute, relative, polar coordinate</p> <p>Draw commands – Line, Ray, Construction line, Spline, rectangle, Polygon, circle, ellipse, Arc, Donut, Polyline, Multiline, Multiline Style, Point, Point Style, Divide, measure</p> <p>Zoom commands – Real-time zoom, pan real-time, zoom window, zoom all, zoom in, zoom out, zoom center, zoom dynamic. Zoom scale, zoom previous.</p>	
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Machine Drawing and CAD – 2nd Year

Theory	Practical
<p>Object Snapping – Dialog box, Toolbar, Tracking, snap p from, end point, mid point, center, intersection, apparent intersection, insertion, quadrant, tangent, perpendicular, node etc.</p> <p>Editing commands – Setting drawing limit, setting units, drawing area parameter, Copy, move, erases, opps, scale, rotate, stretch, lengthen, break, trim, extend, chamfer, fillet, mirror, offset, align, explode, array – rectangular & polar, editing using grips, edit Polly line, edit multiline, using property dialog box., Match property, using single line text, using multiline text, editing text, creating text style.</p> <p>Dimensioning technique – Linear, Aligned, Radius, Diameter, Angular, Baseline, Continuous, Leader, Center mark, creating dimensioning style.</p> <p>Block, Wblock, Attribute.</p> <p>Hatch, Boundary, Region.</p> <p>Object property toolbar – layer control, color control, Line type control, line weight control, working with layers, (freeze, thaw, lock, unlock, plot etc.)</p> <p>Printing and using scale in the drawing.</p>	<p>Practice on Small Drawing Objects using Commands in</p> <p>Draw Menu Practice of Editing command on above drawing objects, Dimensioning Drawing</p> <p>Creating Title block, Creating Part List, Material List using Text in AutoCAD,</p> <p>Drawing Plan, Elevation, Section, in AutoCAD for various mechanical objects, machine part etc.</p>
<p>Viewing Orthographic projections, Viewing Isometric projections, Plan View, Aerial View Window, Using Named Views, Using multiple Tiled View ports – New view ports, Polygonal View ports, object viewports, named view ports, joining viewports, Floating viewports in paper space, Region, Redraw, Regen all command. Shading the model – 2D wireframe, 3D wireframe, Flat shaded, Gauged shaded, hidden view Region, Redraw, Regen all command.</p> <p>Interacting Viewing in 3D – 3D orbit command, panning, zooming, adjusting the view, Adjusting the camera</p>	<p>Suitable CAD Practical (Command Practice) based on the Theory.</p> <p>Creating Simple 3D Model of Machine assemblies required 3D view from all sides.</p>

distance, swiveling the camera, Continuous orbit, using Visual aids – Compass, Grid, UCS icon etc Concept of Wire frame modeling, Surface modeling, Solid modeling, Concept of Thickness & Elevation	Practice of using AutoCAD Mechanical Desktop package for creating various 3D Machine Elements.
<p>Surface modeling – Ruled surface, Edge surface, Revolve surface, Tabulated surface, 2D solid, 3D face, Using Predefined 3D surface objects – Box, pyramid, Wedge, dome, sphere, cone, torus, dish, mesh.</p> <p>Solid modeling – Extruding solid, Revolving solid, Slicing & Interfering solid, using predefined 3D solid objects - Box, pyramid, Wedge, Cylinder, Cone, Torus Modifying 3D Solid object – 3D array, 3D mirror, 3D Rotate, Trim, Extend, Fillet, Chamfer etc.</p> <p>Boolean operation – Union, Subtract, intersect.</p>	<p>Creating, Rendering, and Viewing Various Machine parts and assemblies Elements like different types of Screws, bolt, nut, nail, rivet, keys, cotter, locking devices, stud, plates, angle, channel, sockets, cover, packings, gasket, belt, wheels, gear, grooved parts, casting, supports base plates, pipe joints, I section joints etc.</p>

Machine Drawing and CAD – 2nd Year

Theory	Practical
<p>Solid Editing – Extrude face, move face, offset face, delete face, rotate face, taper face, color face, copy face, color edge, copy edge, imprinting the object, Cleaning, separating objects, shelling the solid Checking validity of solid object.</p> <p>Rendering 3D solid – Rendering options / Rendering procedure – query, crop window, skip dialog box method, Rendering, using light effects in rendering – Distance light, point light, spot light, using Sun angle calculator for shaded model, modifying lights parameter, using lights in scene.</p> <p>Applying material effect to solid object. Using material library. Mapping background. Using background images Printing the 3D rendered view / drawing.</p>	<p>Creating, Rendering, Viewing, Generating JPEG images for Complete assembly model, Printing Photo with various View of machine assemblies,</p> <p>Creating Slide show presentation of such views of assembly model including All four side view, 3D view from four corner, Isometric View, Perspective View etc.</p> <p>Introduction to 3DS Max Software Package for animation Purpose.</p> <p>Introduction to Pro-Engineer, CATIA Software.</p>

List of Books

Machine Drawing

- 1] N.D.Bhatt Elements of Engineering Drawing 49TH 2005 Charotar publishing house,opposite Amul dairy, court road Anand India
- 2] N.D.Bhatt Machine Drawing 40TH 2005 Charotar publishing house,opposite Amul dairy, court road Anand India

Computer Fundamental

- 1] Vikas Gupta Comdex Computer Course Kit First Dreamtech
- 2] Henry Lucas Information Technology for management 7Th Tata Mc-Graw Hills
- 3] B.Ram Computer Fundamentals Architecture and Organisation Revised 3rd New Age International Publisher

CAD Books

- 1] Reference Manual of AutoCAD AutoDesk
- 2] Reference Manual of Felix cad Felix CAD
- 3] Reference Manual of Intel CAD
- 4] Reference Manual of Auto Civil
- 5] Reference Manual of 3D-Max

List of Tools and Equipment

A] General Class room

Sr	Name of Item	No.
1	Steel lockers 8 compartments with individual lockers (1980 x 910 x 480 mm)	4
2	Chair with writing pad	25
3	Steel almari with self 6.5' x 3' (18 gauge)	2
4	Steel table 4' x 3'	2
5	Teacher chair	2

B] For Computer Fundamental and CAD Practical

Sr	Name of Item	No.
1	Computer System P4 with accessories Complete with license OS. Compatible for- to run AutoCAD 2010 and Windows 7 OS.	5+1
2	Plotter- HP Design Jet 500 latest model	1
3	Scanner	1
4	Computer table	5+2
5	Chair for computer	10+2
6	Laser Printer	1
7	AutoCAD 2010 or above Software	1
8	M. S. Office Software	1
9	Pro- Engineering –V-4 Student Version	1
10	CATIA R-17 – Evolution Student Version	1

Subject Name - **General Fitting Technology (TH & PR)**

Subject Code - **30340012**

First Year

Theory	Practical
Importance of safety and general precautions observed in the Institute and in the section. Importance of the course in the development of industrial economy of the country. What is the related instructions subjects to be taught achievement to made. Recreational, medical facilities and other extra curricular activities of the Institute (All necessary guidance to be provided to the new comers to become familiar with the working of Industrial Training Institute System including stores procedures.	Familiarization with the Institute, importance of training, Machinery used in the course, types of work done by the trainees in the course, introduction to safety equipment and their uses.
Safety accident prevention linear measurements its units dividers, calipers, hermaphrodite, center punch dot punch, their description and uses of different types of hammers, description, use and care of 'V' Blocks, marking off table.	Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions sawing different types of metals of different sections.
Bench vice construction, types, uses, care & maintenance, vice clamps, hacksaw frames and blades, specification description, types and their uses, method of using hacksaws.	Filing Channel Parallel Filing. Filing Flat and Square (Rough Finish).
Files specification, description, materials grades, cuts file elements uses, Measuring standards (English Metric units) angular measurements subdivisions, try square, ordinary depth gauge protector description, use and care.	Filing practice, surface filing marking off straight and parallel lines with odd leg calipers and steel rule, marking practice with dividers oddleg calipers and steel rule (Circles, arcs, parallel lines).
Marking of and layout tools, dividers, scribing block, oddleg calipers, punches description, classification material care & maintenance.	Marking of straight lines and arcs using scribing block and dividers chipping flat surfaces along a marked line.
Calipers type material constructional details uses care & maintenance of cold chisels materials, types, cutting angles.	Marking filing , filing square, use of trisquare
Marking media marking blue – Prussian blue –red lead, chalk and their special application description, Use , care and maintenance of scribing block.	Marking according to simple blue prints locating position of holes scribing lines on chalked surfaces with marking tools finding center of round bar with the help of 'V' block and marking block, Joining St. line to an arc.
Surface plate and ancillary marking equipment 'V' block , angle plates, parallel block, description types and uses, workshop surface plate and master surface plate their uses accuracy, care and maintenance.	Chipping Chip slots & oils grooves (Straight)

Types of files convexing , taper, needle care and maintenance of files various types of keys, allowable clearance & tapers ; types, uses of key pullers	Filing flat, square, and parallel to an accuracy of 0.5 mm ,. Chip curve along a line mark out, Key way at various angles & cut key ways
Physical properties of engineering metal ; colour , weight, structure, conductivity, magnetic, fusibility, specific gravity, Mechanical properties , ductility, malleability, hardness, brittleness, toughness , tenacity , elasticity.	File thin metal to an accuracy of 0.5 mm, chip chamfer, grooves and slots.
Drill process ;common type bench type pillar type, radial (type) , gang and multiple drilling machine.	Saw along a straight line, curved line on different sections of metal, straight saw of thick section M.S angle and pipes
Micrometer outside and inside principle, constructional features, parts graduation reading, use and care, Micrometer depth gauge, parts, graduation, reading, use and care.	Files steps and finish with smooth file accuracy ± 0.25 mm. File and saw on M.S square and pipe weds
Vernier calipers, principle, construction , graduations, reading, use and care. Vernier depth gauge construction, graduations, reading , use and care . Vernier bevel protractor, construction, graduations, reading, use and care , Dial Vernier Caliper	File radius along a marked line (Convex & Concave) & match. Chip step and file.
Drill holding devices : material , construction and their uses. Drill processes : common type (bench type, pillar type, radial type) , gang and multiple drilling machine. Revision and Test	Punch , letter and number (letter and number punch) use of different punches Revision and Test
Safety precautions to be observed in a smith shop forge: Necessity, description uses, fuel used for heating, bellows blowers description and uses	Prepare forge. Fire for heating metals. Forge a square rod from round stock. Judge the forging temperature of various metals.
Anvil and swage—blocks Description and uses, Forging tools hammers band and sledge description and uses . Chisels , set hammers, flatters, hardier, fuller swage & uses	Forge M.S. bar to square Octagon and hexagon
Measuring and checking tools steel rule, brass rule, calipers, ‘T’ Square description and uses, General idea about the main operations performed in a forging shop such as upsetting, drawing , twisting, bending , punching, drifting , welding	Forge flat Chisel grind and heat treat chisels
Heat treatment –necessary, various heat treatment methods such as normalizing, annealing, hardening and tempering. Power hammer construction features, method of operating and uses	Forge-punches, screw drivers, chisels, grind them to shape and heat treat to requirement, bending metals to angles, curves & twisting. Preparation of brackets

Safety precautions to be observed in a sheet metal workshop sheets and sizes, commercial size and various types of metal sheets coated sheets and their uses as per ISI specifications	Marking of straight lines, circles , profiles and various geometrical shapes and cutting the sheets with snips. Marking out of simple development marking out for flaps for soldering and sweating
<p>Marking and measuring tools wing compass</p> <p>Prick punch tin man's square tools, snips , types and uses.</p> <p>Tin man's hammers and mallets type-sheet metal tools, stakes –bench types, parts their uses, Soldering iron, types specifications, uses. Trammel, description, parts, uses. Hand grooves specifications and uses</p>	<p>Make various joints, wiring hemming , soldering and brazing form locked, grooved and knocked up /single hem straight and curved edges form double hemming.</p> <p>Punch holes – using hollow and solid punches . Do lap and butt joints.</p>
<p>Solders-composition of various types of solders, and their heating media of soldering iron.</p> <p>Fluxes : types , selection and application – joints and wiring – various types of metal joints, their selection and application Tolerance for various joints, their selection & application</p>	Bend sheet metal into various curvature – form wired edges straight and curves. Fold sheet metal at an angle using stakes, Bend sheet metal to various curvature, Make simple square – container with wired edge and fix handle.
<p>Rivets – Tin man's rivets, types, sizes selection for various works</p> <p>Riveting tools, dolly , snaps ,. Description and uses, Method of riveting shearing machine description, parts and uses</p>	<p>Make square tray with square soldered corner</p> <p>Make funnel as per development and solder joints. Make riveted lap and belt joint.</p>
Safety –importance of safety and general precautions observed in a welding shop. Precautions in electric and gas welding. (Before during , after) Introduction to safety equipment and their uses	Striking and maintaining arc, straight line head
Hand tools: hammers , welding description, types and uses, Machines and accessories, welding transformer, welding generators, description principle, method of operating	Make square butt joint and 'T' fillet joint –gas and arc. Do setting up of flames, fusion runs with and without filler rod, gas and arc.
H.P. welding equipment description, principle method of operating L.P. welding , equipment, description, principle , method of operating types: Joints – Butt and fillet as per BIS specification.	Make butt weld and corner fillet welding Gas and Arc, Practice in hard soldering and silver soldering
<p>Oxygen cutting machine description, parts, uses, method of handling cutting torch- description , parts function and uses.</p> <p>Gases and gas cylinder – description , kinds main difference and uses.</p>	Do gas cutting

Safety precautions to be observed while working on a lathe. Lathe specification, and constructional features. Lathe main parts- descriptions, bed head , stock. Carriage, tail stock, feeding and thread cutting mechanisms, Between center work catch plate , dog, simple description of a facing and roughing tool and their applications	True job on four jaw chuck using knife tool face both the ends , Center drill both ends for holding between centers, Using roughing tool parallel turn ± 0.1 mm . Measure the diameter using out side caliper and steel rule.
Lathe cutting tools Brief study of the nomenclature of lathe cutting tools and necessity of correct grinding, solid and tipped , throw away type tools, cutting speed and feed and comparison for H.S.S carbide tools. Use of coolants and lubricants.	Grind the facing, parting and form tools, plain ,turn, step turn, holding job in three jaw chuck – deburr chamfer- corner round the ends, Shoulder : Square filleted –
Chuck and chucking the independent four jaw chuck. Reversible features of jaws, the back plate, Method of clearing the thread of the chuck- mounting and dismounting chucks , chucking true, face plats, drilling method of holding drills in the tail strock , Boring tools and enlargement of holes.	Cut grooves, square , round ‘V’ groove. Make a mandrel –turn diameter to size, knurl the job
General turning operations parallel on straight turning. Stepped turning grooving , shape of tools for the above operation Appropriate method of holding the tools on tool post or tool rest. Knurling tools description , grade, use, speed and feed , coolant for knurling	Bore holes spot face, pilot drill, enlarge hole, using boring tools make a push. Step bore- cut ramess turn hole diameter to sizes
Taper-definition use and method of expressing tapers .standard tapers –taper calculations.	Turn taper (Internal and external) Turn taper pins. Turn standard tapers to suit with gauge
Screw thread definition – uses and application , Terminology of screw threads, square , worm buttress (non standard –screw threads) , Principle of cutting screw thread in centre lathe –principle of cutting screw thread –use of centre gauge, setting tool for cutting internal and external thread cutting –use of screw pitch gauge, checking the screw thread.	Cut threads using taps & dies on lathe by hand, cut ‘V’ thread- external . Prepare a bolt – cut “V” thread internal –prepare a nut and match with the bolt.
Drill –material, types, (taper shanks straight shank) parts and sizes , Drill angle –cutting angle for different materials. Cutting speed, feed . R.P.M. for different materials	Mark off and drill through holes –drill on M.S. flat , file radius and profile to suit gauge
Drill troubles : causes and remedy Equality of lips , correct clearance, dead centre, length of lips, Drill kinds :fractions , metric, letters and numbers, grinding of drill	Step fit, angular fit, file and make angle , surfaces (Bevel gauge accuracy : degree) make simple open and sliding fits
Grinding wheel : Abrasive, grit grades specification , use mounting and dressing Bench grinder parts and use-radius gauge, fillet gauge, material, construction, parts fraction and metric , different dimension convex and concave uses care and maintenance.	Enlarge hole and increase internal dia. File cylindrical surface. Make open fitting of curved profiles

Radius gauge, feeler, hole gauge, and their uses.	Make the circles by bridging a previously drilled hole . Test angular match up
Vernier height gauge :Material construction, parts, graduations (English & Metric) uses, care and maintenance, Pig Iron : manufacturing process (Blast furnace)types, properties and uses.	Inside square fit , make combined open and sliding fit, straight sides “T” fit
Cast iron : manufacturing process (Cupola furnace) types, properties and uses, Wrought iron : manufacturing process (Fuddling and Astor process) properties and uses.	File fit combined open angular and sliding sides. File internal angles 30 minutes accuracy open angular fit.
Steel : manufacturing process Plain carbon steels types, properties and uses	Make sliding fit with angles other than 90 dreg. Sliding fit with an angle.
Non-ferrous metals (copper, aluminum, tin, lead, zinc) properties and uses.	Make simple bracket by bending the twisting non-ferrous metal. Drill small holes (2 mm) Drill holes on sheet metal, bend sheet for round bracket
Screw threads: its terminology, parts, types and their uses. Screw pitch gauge: material, parts and uses, Taps British standard (B.S.W, B.S.F., B.A. & B.S.P.) AND METRIC/ BIS (course and fine) – material, parts (shank body, flute, cutting edge). Method of using and use of calculating tap hole sizes. Tap wrench: material, parts type (solid & adjustable types) and their uses removal of broken tap, studs(tap stud extractor).	Form internal threads with taps to standard size (through holes and blind holes) – Drill through hole and tap drill blind hole and tap; prepare stubs and bolt.
Dies: British standard, metric and BIS standard, material, parts, types. Method of using dies . Die stock: material, parts and uses	Form external threads with dies to standard size. Prepare nuts and match with bolts
Counter sink, counter bore and spot facing-tools and nomenclature. Reamer material, types (Hand and machine reamer) kinds, parts and their uses, determining hole size (or reaming), Reaming procedure.	Countersink, counter bore and ream split fit (three piece fitting)
Scrapers and their types, methods of scraping.	Filing & scarping of bearing to close precision.
Vernier micrometer, material, parts graduation, use, care and maintenance.	File and fit combined radius and angular surface (accuracy +/- .5 mm) angular and radius fit. Locate accurate holes. Make accurate hole for stud fit.
Screw thread micrometer: construction, graduation and uses.	Make assembly for dovetail sliding fits using lower pins and screws(+/- 0.04 mm)
Dial test indicator, construction, parts material, graduation. Method of use. Care and maintenance. Comparatore measurement of quality in the cylinder bores.	Make sliding fits assemble with parallel and angular mating surface (+/-0.04 mm)

Preventive maintenance objective and function of P.M. section inspection. Visual and detailed lubrication survey system of symbol and color coating.	Practice on testing of machine tools and general shop maintenance.
Revision simple estimation of materials use of hand books and reference table	Simple repair work, simple assembly of machine parts from blue prints

Second Year

Theory	Practical
Keys and key ways, types, and their uses construction (shape)	Prepare triangle , hexagon on ends of a cylinder bar. Prepare female end and fit
Spring material types and uses.	Make key and key ways on the shaft and fit V grooves and slots on the cast iron block.
Bolts and nuts: material types (hexagonal and square head) and their uses	Make riveted joints (lap and butt joints)
Washers: material, types (spring type plain washer, fiber washer	Drill on cylindrical surface
Simple hydraulic circuit (flat, half round, triangular and hook scraper) and their uses.	Scrape on flat surfaces scrap on curved surfaces and scrap surface , parallels, and test. Make and assemble sliding fits plain surfaces.
Dowel pins: natural construction, types accuracy and uses.	Make simple dowel pins-fitting dowel pins and tap screw assembly.
Screws : material, different types (inch & metric) uses.	Assembly sliding for using keys and dowel pin and screw to 0.02mm plain surfaces.
Testing scraped surfaces: ordinary surfaces without a master plate.	Testing of sliding fitting job, scrap on two flat surfaces-and curved surfaces.
Special files : types (Pillar, Dread nought, Barrow, Warding) description.	File & fit angular mating surface :- plain within an accuracy of $\pm 0.02\text{mm}$ & angular ± 15 minutes angular fitting.
System of drill size. Fractional size: number, letter and metric. Templates and gauges. Introduction, necessity types.	Drill through and blind holes at an angle-drill blind holes “Y” fitting.
Gauge: Introduction, necessity types- description and uses of gauges- types (Feeler screw, pitch, radius, wire gauge)- description and use.	Dovetailed fitting radius fitting .
Limit gauge: Ring gauge, snap gauge, plug gauge, description and use.	Precision drilling, reaming and tapping. Test - job .
Slip gauge: Necessity of using, classification of accuracy, set of blocks (English and Metric) , Details of slip gauge, Metric sets 46 :103: 112 .	File and fit combined fit with straight, angular surface $\pm 0.02\text{ mm}$, hexagonal fitting.

Wringing and building up of slip gauge and care and maintenance. Application of slip gauges for measuring, Sine bar – Principle, application & specification.	
Locking device : Nuts types (Lock nut –castle nut, slotted nuts , sawing nut , grooved nut) Description and use	Drill and ream small dia holes to accuracy – correct location for fitting, Make male and female fitting parts – drill and ream holes not less than 12.7 mm
Lapping : application of lapping material for lapping tools, lapping abrasives charging of lapping tool. Surface finish importance equipment for testing –terms relation to surface finish . Equipment for testing surfaces quality – dimensional tolerances of surface finish.	Sliding fitting – Diamond fitting, lapping flat surfaces using lapping plate
Honing: Application of honing- material for honing tools shapes, grades-honing abrasives. Honing its aim and the methods of performance.	Stepped keyed fitting – test job, Lapping holes and cylindrical surfaces
Interchangeability: Necessity in Eng. Field definition - BIS. Definition , types of limit-terminology of limits and fits-basic size, actual size, deviation, high and low limit, zero line, tolerance zone.	Make a snap gauge +/- 0.02mm.
Different standard system of fits and limits. British std. system BIS system. Method of expressing tolerance as per BIS.	Scrape angular mating surface scrap on internal surface.
Fits: Definition, types description of each with sketch.	Practice in dovetail fitting assembly and dowel pins and cap screws assembly.
Manufacture: The name and type of gauges commonly used in gauging finished product-method of selective assembly “Go” system of gauges, hole plug basis of standardization.	Preparation of gap gauges.
Bearing- introduction ,classification(Journal and Thrust Description of each , ball bearing : Single row, double row, description of each , advantages of double row.	Dovetail and dowel pin assembly –scrape cylindrical bore.
Roller and needle bearings: Types of roller bearing – Description & use of each. Method of fitting ball and roller bearings.	Scrap cylindrical bore and to make a fit – make a cotter jib assembly.
Bearing metals –types, Composition and uses lubricants-purpose of using different types, description and uses of each type.	Scrape cylindrical taper bore check taper angle with sine bar –check taper angle (flat) with sine bar.
Synthetic materials for bearing: The plastic laminate and material their properties and uses in bearings such as phenolic, peilon polyamide (nylon).	Preparation of center squares, drills gauges.

Hardening and tempering purpose of each method ,tempering colour chart	File and fit straight and annular surface internally..
Annealing and normalizing purpose of each method.	Heat treatment of tools .
Case hardening and carburising and its method process of carborising (solid liquid and gas)	Flaring of pipes and pipe joints –heat treatment of cold chisels
Solder and soldering . Introduction –types of solder and flex method of soldering –Hard solder – introduction – types and method of brazing. -	H fitting exercises on lapping of gauges (hand lapping only)
Production of gauges, templates and jigs. The object of importance for preparing inter-changeable components.	Hand ream and fit taper pin drilling and reaming holes in correct location fitting dowel pins, studs and bolts.
Drilling jig – constructional features, types and uses.	Simple jig and fixtures for drilling
Fixtures – constructional features., types and uses.	Prepare a V Block and a clamp. Marking out as per blue print drilling, straight and curve filing. Threading with die, cutting slot, cutting internal threads with taps, making an adjustable spanner.
Pipes and pipe fitting commonly used pipes, pipe bending method , use of bending fixture, pipe threads std, pipe threads – die and tap, pipe vices.	Cutting and threading of pipe length – fitting of pipes as per sketch, conditions used for pipe work to be followed, bending of pipes cold and hot.
Standard pipe fitting, methods of fitting or replacing the above fitting – repairs and erection on rain water drainage pipes, and house hold taps and pipe work. Use of tools such as pipe cutters, pipe wrenches, pipe dies, and taps, pipe bending machine etc.	Practice dismantling and assembling globe valves , slinec valves, stop cocks, seat valves, and non-return valves. Fitting of pipes and testing for leakage.
Fire precautions, causes and types of fires – precautions against out break of fire , fire extinguishers, types and uses.	Practice in handling fire extinguishers of different types , refilling of extinguishers.
Working material with finished surface as aluminum duralum, stainless steel, The importance of keeping the work free from scratches or rust and corrosion the various coatings used to protect metals, protection coat by heat and electrical deposit treatments. Treatments and provide a pleasing finish as Chromium silver plating and nickel plating and galvanising.	Marking detail include male female screw cutting, male and female fitting parts, making and tempering springs.
Aluminum and its alloys. Uses advantages, and disadvantages; weight and strength as compared with steel.	Exercises on finished material as aluminum and stainless steel , marking out cutting to sizes drilling etc. without damage to surface of finished articles.

<p>Tapers on keys and cutters permissible by various standards. Discuss non-ferrous metals as brass, phosphor-bronze, gun metal copper aluminum etc.;. Their composition and purpose where and why used – advantages for specific purposes – surface wearing properties of bronze and brass</p>	<p>Making out for angular outlines – filing and fitting the inserts into gaps. Marking simple drilling jig Marking out - filing to line-drilling and tapping brass and copper jobs.</p>
<p>Power transmission elements, The objects of belts – their sizes and specifications –materials of which the belts are made – selection of the type of belts with the consideration of weather lead and tension – methods of joining leather belts.</p> <p>Vee belts and their advantages and disadvantages - Use commercial belts dressing and resin – creep and slipping – calculation for the size of new belt.</p>	<p>Complete exercises covering the assembly of parts working to detail and arrangement – Drawings., Dismantling and mounting of pulleys, Making replacing damaged keys, Repairing damaged gears and mounting . Repair & replacement of belts.</p> <p>Industrial Visits</p>
<p>Power transmission – coupling – types – flange coupling – Holes coupling – universal coupling – universal coupling and their different uses</p>	<p>Complete exercises covering the assembly of parts working to details and arrangements – drawings. Dismantling and mounting of pulley , Making replacing damaged keys . Repairing damaged gears and mounting them on shafts.</p>
<p>Pulleys- types – solid split and “ V” belt pulleys – standard calculation for determining size crowing of pulleys width of faces – loose and fast pulleys Jockey pulley.</p> <p>Types of drives – open and cross belt drives. The geometrical explanation of the belt drivers at an angle</p>	<p>More difficult work in marking out including tangents templates involving use of vernier protractor.</p>
<p>Power transmission – by gears most common form spur gear, set names of some essential parts of the set – The pitch circles- Diametal pitch velocity ratio of a gear set Helical gear, herring bone gears, bevel gearing , spiral bevel gearing – hypoid gearing, pinion and rack , worm gearing, velocity of ratio of worm gearing. Repair to gear teeth by building up and dovetail method.</p>	<p>Fitting of dovetail slides</p>
<p>Method of fixing geared wheels for various purpose drives. General causes of the wear and tear of the toothed wheels and their remedies – method of fitting – spiral gears- helical gears- bevel gears- worm and work wheels in relation to required drive. Care and maintenance of gears.</p>	<p>Male and female dovetail fitting repairs to geared teeth, repair of broken gear tooth by stud. Repair broken gear teeth by dovetail.</p>
<p>Lubrication and lubricants . How lubrication is done . A good lubricant , viscosity of the lubricant. Main property of lubricant. Main property of lubricant – How a file of oil is formed in journal. Bearing method of lubrication – gravity feed , force(pressure) feed, splash lubrication , Cutting lubricants and coolants: Soluble oil – soaps _sudes _ paraffin – soda water –common lubricating oils and their commercial names selection of lubricants.</p>	<p>Marking out on the round sections for geometrical shaped fittings . Finishing and fitting to size , checking up the faces for universality,</p>

Chains wire ropes and clutches for power transmission , Their types and brief description.	Shaping- parallel black &W-Block.
Discuss the various rivets shape and form of heads _ riveting tools for drawing up the importance of correct head size. The spacing of rivets. Flash riveting use of correct tools-compare hot and cold riveting.	Drilling for riveting . Riveting with as many types of rivet as available – use of counter sunk head rivets- use of counter bore tools to fit cheese head bolts . Use of pop rivets and gun.
Installation maintenance and overhaul of machinery and engineering equipment and alignment of machines.	Dismantling removal and reassemble of a simple machine tool. Dismantling and assemble of pillar type drilling machine.
Clutch : Type positive clutch (straight tooth type , angular tooth type) FRICTION TYPE(flat and conical type). Washers. Types and calculation of washer sizes	Milling- plain ,Slot &angular cutting .
The making of joints and fitting, packing.-The use of lifting appliances, extractor presses and their use . Practical method of obtaining mechanical advantage . The slings and handling of heavy machinery special precautions in the removal and replacement of heavy parts.	Griping –surface & circular. Simple repair of machinery-making of packing gaskets-use of hollow punches, extractor- drifts- various types of hammers and spanners, etc. Practicing, making various knots correct- loading of slings, correct and safe removal of parts. Erect simple machine.

Reference Books

- 1] Element of workshop Technology Vol.-I&II - S.K. Hajra Choudhari
- 2] Elements of workshop technology - Raghuvanshi
- 3] Fitter trade theory and practical book by NIMI

LIST OF TOOLS AND EQUIPMENT FOR THE FIRST YEAR

For a batch of 25 students

Sr. No.	Name of tools & equipment	Qty. Required
1.	Rule steel 15 cm with metric graduations.	5
2.	Square try 10cm blade.	5
3.	Caliper outside 15cm spring.	5
4.	Caliper inside 15cm spring.	5
5.	Caliper 15 cm hermaphrodite	5
6.	Divider 15 cm spring.	5
7.	Scriber 15 cm.	5
8.	Punch center 10 cm .	5
9.	Screw driver 15 cm.	5
10.	Chisel cold 10	5
11.	Hammer ball pein 0. 45 kg. With handle.	5
12.	Hammer ball pein 0. 22 kg. With handle.	5
13.	File flat 25 cm. Second cut.	5
14.	File flat 25 cm smooth.	5
15.	File half round second cut 15cm.	5
16.	Hacksaw frame adjustable 20 – 30 cm.	5
17.	Safety goggles.	5
18.	Dot slot punch.	5
Tools -Instruments &General shop Outfit		
19.	Rule steel 30 cm to read metric.	4
20.	Rule steel 60 cm.	4
21.	Straight edge 45 cm steel.	2
22.	Plate surface 45 cm x45 cm.	2
23.	Marking table 91 x91 x 122 cm.	1
24.	Universal scribing block 22cm.	2
25.	Block – Vee pair 7 cm and 15 cm with clamps.	2

26.	Square adjustable 15 cm blade.	2
27.	Angle plate 10 x 20 cm.	2
28.	Level sprit 15 cm metal.	1
29.	Punch letter 3 mm set.	1
30.	Punch number set 3 mm.	1
31.	Punch hollow 6mm to 19 set of 5.	2
32.	Punch round 3mm x4mm set of 2	2
33.	Portable hand drill (Electric)0 to 6mm.	2
34.	Drill brace hand to 12mm.	2
35.	Drill twist S/S 1.5 to 12mm. By 0.4mm	1set
36.	Drill twist S/S 8mm to 15mm by 1/2mm	1set
37.	Brace ratchet with pillar.	1
38.	Taps and dies complete set in box B .A .	1
39.	Taps and dies complete set in box B.S.F	1
40.	Taps and dies complete set in box whit worth.	1
41.	Taps, dies complete set in box American.	1
42.	Taps and dies complete set in box (Metric).	1
43.	File warding 15cm smooth.	4
44.	File knife edge 15cm smooth.	4
45.	File cut saw 15cm smooth.	4
46.	File feather edge 15cm smooth.	4
47.	File triangular 15cm smooth.	2
48.	File round 20 cm second cut.	2
49.	File square 15 cm second cut.	4
50.	File square 25 cm second cut.	4
51.	Feeler gauge 10 blades.	1set
52.	File triangular20 cm second cut .	2
53.	File flat 30 cm second cut.	2
54.	File flat 20cm bastard.	2
55.	File flat 30 cm bastard.	2
56.	File Swiss type needle set of 12.	2sets
57.	File half round 25cm second cut.	2

58.	File half round 25cm bastard.	2`
59.	File round 30 cm bastard.	4
60.	File hand 15cm second cut.	2
61.	Card file.	2
62.	Stone oil 15cm x 5cm x 2.5cm.	4
63.	Stone carborandum 15cm x 5cm x 5cmx 4cm.	2
64.	Can oil 0.25 liters.	2
65.	Pliers combination 15 cm.	2
66.	Iron soldering 350 gm.	2
67.	Lamp blow 0.55 liters.	2
68.	Spanner whit-worth D>E> 6mm. To 25 mm set of.	2
69.	Spanner adjustable 15cm.	2
70.	Interchangeable ratchet socket set with a 12mm driver-socket range : 4mm set of 8.	1set
71.	“Apollo” box spanner set in mm 3x 4. 6x7,9x11,12x14, 15x19, 22x25, set of 6.	1set.
72.	Glass magnifying 7cm.	2
73.	Clamp tool maker 5cm and 7.5 cm set of 2.	2
74.	Clamp “C” 5 cm.	2
75.	Clamp “C” 10 cm.	2
76.	Reamer adjustable max.9mm 12m, 19mm- set of 3.	1set
77.	Reamer taper 4mm to 9 mm set of 4.	1
78.	Reamer parallel 16mm to 12 mm set of 5.	1
79..	Scraper flat 15 cm.	2
80.	Scraper 3 corner 15cm.	2
81.	Scraper half round 15 cm.	2
82.	Chisel cold 9mm cross cut 9mm diamond.	2each.
83.	Chisel cold 19mm flat.	2
84.	Chisel cold 9mm round nose.	2
85.	Extractor stud EZY- out.	2
86.	Set combination 30 cm.	2
87.	Micrometer 0-2.5 cm outside.	3
88.	Micrometer 25-50 mm outside.	3
89.	Micrometer 50-25mm outside.	4

90.	Micrometer 50-75 mm outside.	1
91.	Micrometer inside 25mm to 50mm with extension rods.	1
92.	Vernier caliper 20 cm.	1
93.	Vernier height gauge 30cm.	1
94.	Veriner level protractor.	1
95.	Screw pitch gauge.	1
96.	Wire gauge , metric standard.	1
97.	Drill twist T/S6mm to 25 mm x 1.5mm.	1set
98.	Drill chuck 12mm.	1
99.	Pipe wrench 40 cm.	1
100.	Pipe wrench 30 cm.	1
101.	Pipe vice No. 4.	2
102.	Adjustable pipe die 0-205 cm cap.	1
103.	Wheel dresser (One for 4 units).	1
104.	Machine vice 10 cm.	1
105.	Machine vice 15 cm.	1
106.	Sleeve drill morse 0-1 , 1-2 . 2-3.	1 Set
107.	Vice bench 12 cm jaw.	5
108.	Vice leg 10-cm jaw.	2
109.	Bench working 240 cm x 120 cm x 60 cm..	4
110.	Almirah ;180 x 90 x 30 cm.	2
111.	Lockers with 8 drawers (standard size).	2
112.	Metal rack 182 cm x 182 cm x 4.5 cm.	1
113.	Desk.	1
114.	Stool.	1
115.	Black board with easel.	1
116.	Fire extinguisher (For 4 Units).	2
117.	Fire buckets.	2
118.	Machines vice.	2
119.	Wing compass 25.4 cm or 30 cm.	2
120.	Hand hammer 1 kg . with handle.	2

Tools for Allied Course – Backsmithy & Sheet Metal work

121.	Hammer smith 2 kg , with handle.	2
122.	Tongs round	2
123.	Tong flat.	2
124.	Smith's square 45 cm x 30 cm.	1
125.	Cold set rodded.	2
126.	Hot set rodded.	1
127.	Swages top & Bottom 12 mm/ 19 mm/ 25 mm (pair)	1 Each
128.	Swage block 35 cm x 35 x 12 cm	1
129.	Flatters (rodded) 55 mm squares.	2
130.	Fuller top & bottom 6 mm,9mm (Pair).	2
131.	Anvil 50 kg.	2
132.	Anvil Stand.	2
133	Shovel	2
134	Trammer	1
135	Racks	2
136	Quenching tank	1 (to be made in the institute)
137	Pocker	2
138	Handle	2
139	Leather apron	2
140	Prick punch	2
141	Mallet	2
142	Snips straight 25 cm	2
143	Setting hammer with handle	2
144	Planishing hammer	2
145	Snip bent 25 cm	2
146	Stake hatchet	2
147	Stake grooving	2
148	Gauge imperial sheet	1

GENERAL MACHNERY INSTALLATION :

1	Anvil 50 kg. On stand	1
2	Drilling machine pillar sensitive 0 –20 mm cap with swivel table motorised with chuck & key	1
3	Drilling machine bench sensitive 0- 12 mm cap motorized with chuck & key	2
4	Forge portable hand blower 38 cm to 45 cm	1
5	Grinding machine (general purpose) D.E. pedestal with 20 cm dia. Wheels rough and smooth with twist drill grinding attachment	1

LIST OF TOOLS FOR THE SECOND YEAR

1	Gauge slip as Johnson metric set	1
2	Carbide wear block 1 mm- 2mm	1each
3	Gauge snap go and no go 25 to 50 mm by 5 mm	1 set
4	Gauge plug single 3ended 5 to 55 mm by 1mm	1set
5	Gauge telescopic	1 set
6	Dial test indicator .01 mm on stand	1
7	Sine bar 125 mm	1
8	Sine bar 250mm	1
9	Lathe tools HSS tipped set	2
10	Lathe tools bit 6mm x 75 mm	5
11	Lathe tools bit 7mm x 75 mm	5
12	Lathe tools bit 9mm x 85 mm	5
13	Arm strong type tool bit holder R.H.	2
14	Arm strong type tools bit holder L.H.	2
15	Arm strong type tool bit holder straight	2
16	Stilson wrenches 20 cm	2
17	Spanner monkey up to 5 cm	2
18	Pipe cutter 6mm to 50mm wheel type	1
19	Pipe face to grip pipe up to 50mm	2

20	Pipe stock and dies complete with stocks , bushing, bushing holders, tap, tap wrenches size covered 19mm 25mm 32mm 6mm 9mm 12mm 19mm 25mm 32mm 38mm 50mm	1 set
21	Pipe bender spool type with stand manually operated	1
22	Adjustable spanner 38 cm long	1
23	Adjustable pipe chain tongs 22 cm long to take pipes from 3 cm to 63 cm	1
24	Dial Vernier caliper 0- 130 mm LCO .05 mm (Universal types)	1
25.	Screw thread micrometer with interchangeable 0.4 – 1.75 mm pitch anvils for checking metric threads 60	1
26	Depth micrometer 0-100 mm 0.01 mm	1
27	Vernier caliper with thumb block 0-130 mm LCO 0.2 mm	1
28	Comperator stand with dial indicator	1
29	Engineers try square (knife and wedge)	1
30	Surface roughness comparison plates ruberts	1 set
