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DEPARTMENT OF EMPLOYMENT AND TRAINING



SYLLABUS FOR INDUSTRIAL SCHOOLS

TRADE : PRECISION MACHINIST



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**SYLLABUS FOR
PRECISION MACHINIST**

**UNDER CODE OF REGULATION FOR
INDUSTRIAL SCHOOLS**

AS APPROVED BY

**DEPARTMENT OF EMPLOYMENT AND TRAINING
CHAPAUK
CHENNAI – 600 005**

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**LIST OF COMMITTEE MEMBERS FOR THE TRADE OF
PRECISION MACHINIST**

1. Thiru Sundararajan
Regional Joint Director
Chennai Region

2. Thiru P. Dwaraka
Assistant Director of Training

3. Bro. Jose Kannampuzha
Principal, Montfort Technical Institute, Chennai – 600016

4. Mr. Peregrine Claremont
Training Officer, Montfort Technical Institute, Chennai-600016

COURSE DETAILS

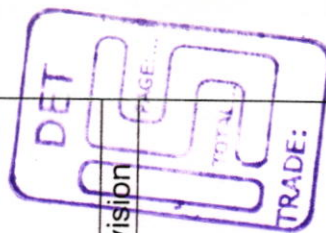
Name of Trade	: PRECISION MACHNIST
Qualification	: 10TH PASS / FAIL
Age	: 14-40 Years
Duration	: 1 Year
Number of Trainees	: 20
Number of Practical hours	: 32 hrs. per week
Number of Theory Hours	: 8 hrs. per week
Number of Workshop Calculation hours	: 2 hrs. per week.
Number of Engineering Drawing hours	: 2 hrs. per week
Space Required	
Workshop	: 600sq. feet
ClassRoom	: 200 sq. feet
Power Required in KW	: 15 k.w.

SYLLABUS FOR THE TRADE OF PRECISION MACHINIST

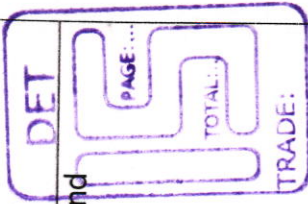
WEEK NO	Practical	Theory	Engineering Drawing	Workshop Science & Cal
1	Introduction Training: Familiarization with the Industrial Training Institute. Importance of the trade in the industry. Various types of machines used. Safety related to each machine.	Importance of good house keeping. Safety precautions to be observed in general and in the machine shop in particular. Accidents and their causes. Basic first aid.	Engineering Drawing and its importance. Instruments used in Engineering Drawing.	Simple Arithmetic: Addition, subtraction, multiplication and division of whole and partial numbers.
2	Introduction to basic hand tools: Fitting tools and measuring tools. Chipping of flat surfaces and grooving. Grinding of various angles on chisels.	Hand tools: Steel rules: Types, graduation and uses. Try square: Types, parts and uses. Surface gauges: types and uses. Chisels: Types, uses and specification.	Lettering practice	Simple Arithmetic: Addition, subtraction, multiplication and division of fractions.
3	Use of marking tools: Punches, try squares, calipers and steel rule. Filing flat surfaces.	Calipers: Outside and inside, firm joint and spring joint, jenny caliper, transfer caliper. Files: Types, shapes grade and cut, classification and uses.	Lettering Practice	Units and measurements
4	Filing to right angles Hacksawing (checking with steel rule and try square).	Vices: Construction, types and uses Hacksaw frames and blades: Types and uses, specification.	Types of lines and their application.	Units and measurement.
5	Drilling holes in flat work, pieces and tapping as per simple drawings.	Taps and dies: types and uses, calculation of tap drill sizes. Types of V threads. Forging Tools: Tongs, swage Blocks, anvils etc.	Types of lines and their uses.	Conversion of units from one system to the other.
6	Filing of plate type polygons	Hammers: Types, uses and specification. Heat treatment processes: Annealing, Normalizing, Hardening and tempering.	Geometrical construction of lines and angles	Fractions and decimals conversion.

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TOTAL: ...
TRADE: ...

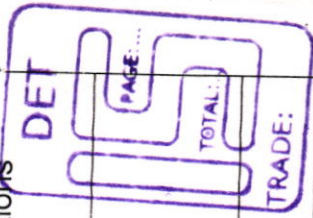
7	Filing male and female square pieces to close limits. Use of the vernier calipers.	Veniers: Calipers, depth gauges, and bevel protractors, construction, graduation and uses.	Geometrical construction: division of lines and angles.	Fractions and decimal conversion.
8	Grinding of a single point cutting tool	Outside micrometers: Types, construction, graduation and uses.	Geometrical construction of plain figures: Triangles	Arithmetic operation of fractions.
9	Introduction to the lathe. Truing of round stock in the independent chuck. Setting the cutting tool in the tool post. Facing and centre drilling work.	Introduction to the lathe. Types of lathes. Construction function and details of the various parts of a lathe.	Geometrical construction of quadrilaterals.	Arithmetic operation of fractions.
10	Parallel turning in between centers. Parting off. Chamfering (using roughing and finishing tools)	Construction function and details of the various parts of a lathe specification of the lathe.	Geometrical construction of polygons.	Problems involving percentages.
11	Truing work in the universal chuck. Facing, centering and step turning.	Speed and feed mechanism of the lathe. Lathe tools: angles and uses.	Geometrical construction of polygons.	Problems involving percentages.
12	Drilling and boring on the lathe.	Chucks: Types and uses. Advantages and disadvantages of each chuck.	Free hand sketching of solid figures: Cube, prisms etc.	Revision
13	Revision-Test-Revision Achievements: The trainee shall be able to:- 1. Do marking, chipping, Hacksawing and filing. 3. Turn work to an accuracy of 0.1mm 5. Read the vernier caliper and outside micrometer.	Revision-Test-Revision	Revision-Test-Revision	Revision-Test-Revision
14	Taper turning by off-set method. Taper turning by swiveling the compound slide. (Checking of taper with precision instruments)	Tapers: Types and uses methods of producing taper. Calculation of off-set and taper angle. Sine bar.	Isometric view of simple solids.	Square root of numbers

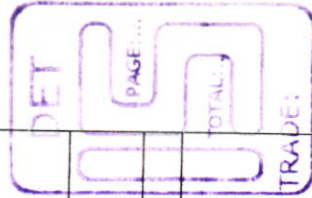


15	Cutting of external and internal V thread. Cutting of external and internal square thread.	Different thread forms. Methods of producing screw thread. Checking of screw threads with screw pitch gauge screw thread micrometer and three wire method.	Isometric view of simple solid figures.	Square root of numbers.
16	Introduction to the milling machine. Setting of work on the milling machine. Setting of the cutter on the arbor.	Milling machine: Types and construction. Speed and feed mechanism of the milling machine.	Orthographic projection (third angle projection)	Ratio and proportion: Problems involving ratio and proportion.
17	Step milling using side and face cutter	Classification of milling cutters. Types and uses. Parts of a plain milling cutter.	Orthographic projection (third angle projection)	Problems involving ratio and proportion.
18	Milling six faces of a solid Block and checking the accuracy with the help of try square and vernier caliper.	Work holding devices for milling, Cutter holding devices	Methods of dimensioning	Problems involving ratio and proportion.
19	Straddle milling and gang milling.	Milling operations: End or plain milling and peripheral milling. Up milling and down milling. Plain milling, angular milling, form milling slot milling, straddle milling and gang milling.	Orthographic projection (Scale)	Simple algebra-addition and subtraction.
20	Milling concave and convex surfaces	Indexing heads:- Constructional details and function	Orthographic projection	Simple algebra – multiplication and division
21	Setting and aligning the index head. Milling a square and hexagon by rapid indexing	Calculation for various types of indexing	Isometric and Orthographic projection of simple Blocks	Simple algebra – addition, subtraction, multiplication and division



22	Milling of dovetail and 'T' slot	Gears: Elements of a spur gear. Calculation of spur gear proportions	Isometric and orthographic projection of simple solids	Solution of simple equations
23	Milling of spur gears having even and odd number of teeth	Quality control: Importance and necessity of quality	Orthographic projection (first angle projection)	Solution of simple equations
24	Square thread cutting (left hand and right hand)	Screws thread cutting on the lathe: Simple and compound gear trains Calculation of gear train	Orthographic projection and free hand sketching of simple hand tools	Factorization
25	Cutting of multi start V thread on the lathe	Difference between single start and multi-start thread. Difference between right hand and left hand threads	Orthographic projection and free hand sketching of simple hand tools	Factorization
26	Revision – Test – Revision Achievements: The trainee shall be able to: 1. Operate the Milling Machine 2. Do taper turning to an accuracy of $\pm 0^{\circ} 15'$ 3. Cut screw threads on the lathe 4. Mill work to an accuracy of 0.1mm	5. Mill spur gears	Revision – Test – revision	Revision – Test – Revision
27.	Cutting of acme thread (male and female)	Screw threads: Calculation of proportions for different forms of threads	Orthographic projection	Solution of simple equations
28	Checking of alignment of lathe centers. Adjustment of centers. Turning in between centers.	Lathe Centers: Types and uses. Turning tapers by the taper turning attachment	Isometric and orthographic projection	Work power energy
29	Turning of irregular work on the face plate	Face Plate: Construction and use. Balancing of face plate.	Isometric and orthographic projection	Work, power energy
30	Counter sinking Counter boring and spot facing on the pillar type drilling machine	Drilling Machines: Construction, types and uses. Drills and reamers.	Isometric and orthographic projection	Work power energy





31.	Practice on the radial drilling Machine	Limits, fits and tolerances	Isometric and orthographic projection	Properties of metals and their importance.
32.	Cutting a reamer on the milling machine	Gauges and gauging	Isometric and orthographic projection	Properties of metals and their importance.
33	Milling a drill	Cams: Introduction development and use	Isometric and orthographic projection	Geometry
34	Milling a plate cam	Cutting speed, feed and depth of cut for various materials calculation of cutting speed and cutting time	Isometric and Orthographic projection	Problems involving Pythagoras theorem
35.	Milling of tongue and groove mating work (checking with precision instruments)	Combination set its components inside micrometers and depth micrometer	Simple sectional views	Area of plain figures – square and rectangle
36	Milling a cylindrical cutter	Spiral : Introduction, types and elements lead and helix angle calculation	Simple sectional views	Area of plain figures
37	Milling a drum can	Vertical milling machine its parts and construction	Orthographic projection	Areas of circles.
38	Boring of casting on the vertical milling machine	End mills, T slot Cutters, dovetail cutters and wood ruff key slot cutters	Types of rivets	Area of polygons
39	Revision – test – Revision	Revision – Test – Revision	Revision – Test – Revision	Revision – Test – revision
	Achievements:			
<p>The trainee shall be able to:</p> <ol style="list-style-type: none"> 1. Do turning to an accuracy of $\pm 0.06\text{mm}$ 2. Do milling to an accuracy of $\pm 0.06\text{mm}$ 				
40.	Milling gears by differential indexing	Vernier gear tooth caliper: Its construction and use. Slip gauges: Calculation	Types of rivet joints	Area of Polygons
41.	Milling a hexagonal hole in a plate with the help of the slotting attachment	Elements of a milling cutter: Rake angle, Primary and secondary clearance angles, lead etc.	Nomenclature of V thread	Volume of solids

42.	Milling splines (external)	Methods of milling splines calculation and selection of cutter	Types of threads	Mensuration of solids
43.	Milling a helical groove	Spiral milling: Lead, pitch, helix angle: calculations involved	Sketching of nuts and bolts	Mensuration of solids
44.	Milling a helical gear	Helical Gear: calculation of gear tooth proportions	Sketching of nuts and bolts	Mensuration of solids
45.	Milling a bevel gear	Bevel gears: Introduction Geometry, use of bevel gear	Sketching of machine accessories Vise etc.	Mensuration of solids
46.	Milling a rack	Rack milling attachment calculation of linear pitch and circular pitch	Sketching of machine accessories tool posts	Mensuration of solids
47.	Cutting a worm and worm wheel & Surface grinding of Parallel surface	Worm and worm wheels: Introduction, geometry and use	Blue print reading	Simple shop problem
48.	Graduation of a steel rule on the milling machine & cylindrical grinding of parallel surface	Surface grinders construction, function details	Blue print reading	Simple shop problems on estimation of material, time taken for machining a job, etc.
49.	Milling a side and face cutter & cylindrical grinding of taper shafts	Cylindrical grinders construction function details	Blue print reading	Simple shop problems on estimation of material, time taken for machining a job, etc.
50.	Eccentric turning	Revision	Blue print reading	Simple shop problems on estimation of material; time taken for machining a job etc.
51.	Internal Examination			
52.	Common Examination			
Achievements: The trainee shall be able to:		<ol style="list-style-type: none"> 1. Operate the lathe 2. Operate the horizontal & vertical milling machine 3. Cut all forms of external and internal screw threads 4. Mill spur gears, helical gears, bevel gears and racks 5. Turn work to an accuracy of $\pm 0.06\text{mm}$ on dia and 0.2 on length. 		
		<ol style="list-style-type: none"> 6. Operate the surface grinder 7. Operate cylindrical grinder 8. Mill work to an accuracy of 0.1mm 9. Work according to a drawing 		



INDUSTRIAL SCHOOLS
TRADE SYLLABUS – REVISED

Name of the Trade : PRECISION MACHINIST.

SPACE REQUIRED:

(1) Workshop/Lab : 600 sq. ft.
(2) Class Room : 200 sq ft.

List of Tools & Equipments
For The Trade of PRECISION MACHINIST
(FOR A BATCH OF 20 TRAINEES)

Sl. No.	ITEM	QUANTITY REVISED
1	Steel rule (300mm) graduated both in English and Metric units	10
2	Steel tape (2mts) in a case	1
3.	Outside spring joint caliper (150mm)	5
4.	Inside Spring joint caliper (150mm)	5
5.	Hermaphradite caliper (150mm)	5
6.	Spring joint divider (150mm)	5
7.	Scribing black – Universal (300mm)	2
8.	Straight edge – Steel (1000mm)	1
9.	Straight edge – steel (500mm)	1
10.	Spirit level (2, 250, 0.5 mt)	1
11.	Magnifying glass (75mm)	2
12.	Outside Micrometer (0 to 25mm)	4
13.	Outside Micrometer (25 to 50mm)	4
14.	Outside Micrometer (50 to 75mm)	1
15.	Direct reading universal vernier caliper (300mm)	2
16.	Direct reading vernier caliper with dial (300mm)	1
17.	Vernier height gauge (250mm)	1
18.	Vernier gear tooth caliper	1
19.	Vernier bevel protractor with 150mm blade	1
20.	Telescope gauge (13 to 300mm)	1set
21.	Bevel gauge (200mm)	1
22.	Sine bar (200mm)	1
23.	Compound dial gauge with stand – metric	1
24.	Dial test indicator (type1, grade A) with magnetic base	1
25.	Centre gauge 60°	1
26.	Center gauge 55°	1
27.	Center gauge 29°	1
28.	Slip gauge set (Metric)	1
29.	Screw pitch gauge (Metric and inch)	1

30.	Combination set (200mm)	1
31.	Radius gauge Metric set (1 to 7.5mm)	1
32.	Limit plug gauges (5 to 25mm by 2.5mm)	1set
33.	Ring gauges (5 to 25mm by 2.5mm)	1set
34.	Taper gauges (Merge Taper 1 to 5)	1set
35.	Feeler gauge	1set
36.	Centre punch (100mm)	10
37.	Ball pein hammer (0.5kg)	3
38.	Ball pein hammer (0.75kg)	2
39.	Safety glasses	10
40.	Surface plate (400x400mm) grade 1	1
41.	Table for surface plate (900x900x1200mm)	1
42.	Marking off table (1200x1200x900mm)	1
43.	Vee block 100/7-8—A	3
44.	Try square (300mm)	3
45.	Angle plate (200x200x100mm)	3
46.	Angle plate- Adjustable (250x175x150mm)	2
47.	Solid parallels in pairs – different sizes	10 pairs
48.	Oil can (500ml)	5
49.	'C' clamp (100mm)	2
50.	'C' clamp (200mm)	2
51.	Screw driver (300mm) heavy duty	6
52.	Lead hammer (1kg)	3
53.	Spindle blade screw driver (100mm)	6
54.	Double end spanners (series 2)	3 sets
55.	Allen keys (2.5 to 12mm)	3 sets
56.	Adjustable spanner (300mm)	3
57.	Reduction sleeves (Morse taper 1-2, 3-1, 4-1, 5-1, 6-1)	2
58.	Cutting pliers (200mm)	3
59.	Engineers screw driver	10
60.	Smooth file – flat (200mm)	10
61.	Flat bastard file (300mm)	10
62.	Flat second cut file (250mm)	10
63.	Square file – second cut (250mm)	5
64.	Half round file	5
65.	Round file	5
66.	Triangle file	5
67.	Needle file set	2
68.	Number drills – H.S.S. (parallel shank)	1set
69.	Letter drills – H.S.S. (parallel shank)	1set
70.	Twist drills (3 to 13mm by 0.5mm) parallel shank	1set
71.	Center drill A1 to 5	3 set
72.	Flat cold chisel (25x200mm)	10
73.	Tap and die set in a box (metric)	1set
74.	Tap and die set in a box (B.S.W)	1set

75.	Drills – H.S.S. – taper shank (13 to 30mm by 0.5mm)	1 set
76.	Reamer (6mm to 25mm by 1mm)	1 set
77.	Reamer adjustable (10 to 15mm)	1 set
78.	Tool bits – HSS 6mm square	10
79.	Too bits – HSS 10mm square	10
80.	Tool bit holder (arm strong) L.H.	5
81.	Tool bit holder (arm strong) R.H.	5
82.	Assorted tools for lathe of different shapers and sizes	As required
83.	Hacksaw frame – adjustable (250 to 300mm)	3
84.	Knurling tool (Set of 3) straight and diamond	1 set each
85.	Carbide tipped tools of different shapes and sizes (throw away tips)	3 sets
86.	Cylindrical plain milling cutter dia 63x90 bore to suit machine arbor	5
87.	Cylindrical plain milling cutter dia 80x90 bore to suit machine arbor	5
88.	Side and face cutter B 80x8	4
89.	Side and face cutter B 160x10	4
90.	Side and face cutter B 100x12	2
91.	Side and face cutter B 160x16	2
92.	Side and face cutter A 200x20	2
93.	Equal angle cutter 45° /100	2
94.	Equal angle cutter 60°/100	2
95.	Equal angle cutter 90° /100	2
96.	Single angle cutter 50x12x55°	2
97.	Double angle unequal angle cutter 63x18x60°	2
98.	Double angle unequal angle cutter 80x332x70°	2
99.	Double angle unequal angle cutter 63x18x60°	2
100.	Double angle unequal angle cutter 100x36x75°	2
101.	Single angle cutter 63x18x45° R.H	1
102.	Single angle cutter 63x18x45° L.H	1
103.	Single angle cutter 63x18x60° R.H	1
104.	Single angle cutter 63x18x60° L.H	1
105.	Involute gear cutter – cutter No 1 to 8	1 set
106.	End mills – parallel shank (3 to 30mm)	2 sets
107.	7 slot end mill 32x8	2
108.	Dove tail end mill 32x8x60°	2
109.	Center lathe Center purpose – all gear type height of centers 150mm or more admit between centers 1000 mm or more supplied with Universal and independent chucks (250mm or more), face plate, driving plate, driving dogs, live and dead centers, fixed and traveling steadies, taper turning attachment.	2

110.	Pillar type drilling machine 2mm capacity – supplied with reducing sleeves (Morse taper 1-3, 2-3), drill chuck 20mm capacity, swivel base machine vice.	1
111.	Radial drilling machine (1200mm) Supplied with: reducing sleeves, swivel base machine vice, tapping attachment.	1
112.	Milling machine – horizontal universal (size I) with attachments such as: Universal indexing head, vertical milling head, slotting attachment, rotary table, rack cutting attachments, swivel base machine vice arbors.	1
113.	Milling machine – horizontal, plain (size2) Supplied with: plain indexing head swivel base machine vice, arbors.	1
114.	Milling machine – vertical Supplied with: adaptors, collet adaptor and collets (3 to 3mm), swivel base machine vice,	1
115.	Pedestal grinder fitted with aluminium oxide and silicon carbide grinding wheels	1
116.	Fitting tables fitted with 4 bench vices of 100mm jaws	4
117.	Steel lockers for 20 trainees	1
118.	Steel table and chair for instructor	1 set
119.	Steel cupboard 180x90x45cms	1
120.	Black board with easel	1
121.	First aid box	1
122.	Surface grinder supplied with magnetic chuck	1
123.	Cylindrical grinder supplied with chuck & live and dead center	1