

Syllabus for the trade

of

MACHINIST

(SEMESTER PATTERN)

under

Craftsman Training Scheme (CTS)

Designed in – 2013

By

**Government of India
Ministry of Labour & Employment
Directorate General of Employment & Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Block - EN - 81 SECTOR – V, SALT LAKE CITY,
KOLKATA – 700 091**

**List of members of Trade Committee meeting for the
trade of “MACHINIST” Held on 12.08.2010 & 13.08.2010 at CSTARI, Kolkata**

Sl. No.	Name and Designation SRI/SRIMATI	Organization	Remarks
1	S.D.Lahiri, Director	C.S.T.A.R.I, Kolkata	Chairman
2	S. Bhattacharya, Director	W.B.R.E.D.A, Kolkata	Member
3	Amarnath Sanyal, Addl, Director	I.EM, Kolkata	Member
4	R. Gangopadhyay, Lecturer	Kanchrapara Railway Workshop, Eastern-Railway	Member
5	R, N. Banerjee, Director	Sunshine Power Products, Kolkata	Member
6	P. K. Ghosh, Training Manager	G.R.S.E. Ltd, Kolkata	Member
7	S. K. Pal, Manager	M/s Mascot Integrated Industry, Kolkata	Member
8	Dr. Soumen Bose, Dy, Director	Directorate of Industrial Training, WB	Member
9	Dibyendu Paul, Lecturer	Sahaj Academy, Kolkata	Member
10	Dr. Tapas Kr Majumder, Manager	B S N L, Kolkata	Member
11	S.K.Bose, Manager	Trans Bio Energy Ltd, Kolkata	Member
12	Monisha Sarkar, Asstt Manager	Trans Bio Energy Ltd, Kolkata	Member
13	Dr.K. mukhopadhya, Director	AGNI, Kolkata	Member
14	Anupam Bose, Manager	Geetanjali Solar, Kolkata	Member
15	A Majumder, DE	W.B.R.E.D.A, Kolkata	Member
16	Joy Chakraborty, DE	W.B.R.E.D.A, Kolkata	Member
17	Utpal Kr Roy, Supervisor	W.B.R.E.D.A, Kolkata	Member
18	A.Ghosh, Supervisor	W.B.R.E.D.A, Kolkata	Member
19	Moloy Kr Mondal, Supervisor	W.B.R.E.D.A, Kolkata	Member
20	Rudrendu Basu, Asstt. Director	W.B.R.E.D.A, Kolkata	Member
21	S.K.Biswas, Asstt Director	W.B.R.E.D.A, Kolkata	Member
22	D.K.Hazra, Spervisor	W.B.R.E.D.A, Kolkata	Member
23	A.Karmakar, Supervisor	W.B.R.E.D.A, Kolkata	Member
24	Gautam Banerjee, Manager	ESAB India Ltd, Kolkata	Member
25	M.K.Saha, Trg Superintendent	G.R.S.E. Ltd. Kolkata	Member
26	P.Majumder, Chief Consultant	Park Chember Housing Development, Kolkata	Member
27	Rabin Debnath, Asstt. Director	Directorate of Industrial Training, WB	Member
28	Sib Chandra Pal, Instructor	Govt, ITI, Howrah Homes, WB	Member
29	D.P.Sarkar, Instructor	Govt, ITI, Howrah Homes, WB	Member
30	Anil Kumar, Joint Director of Trg	C.S.T.A.R.I, Kolkata	Member
31	L. K. Mukherjee, Dy.Director of Trg	C.S.T.A.R.I, Kolkata	Member
32	A. Nandi, Dy.Director of Trg	C.S.T.A.R.I, Kolkata	Member
33	N.Nath, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
34	P.K.Dutta, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
35	S. B. Sarder, Asstt. Director of Trg	C.S.T.A.R.I, Kolkata	Member
36	R. N. Manna, Trg. Officer	C.S.T.A.R.I, Kolkata	Member
37	L. M. Pharikhal, Trg-Officer	ATI, Kolkata	Member

List of members attended the Workshop to finalize the syllabi of existing CTS into Semester Pattern held from 6th to 10th May'2013 at CSTARI, Kolkata.

Sl. No.	Name & Designation	Organisation	Remarks
1.	R.N. Bandyopadhyaya, Director	CSTARI, Kolkata-91	Chairman
2.	K. L. Kuli, Joint Director of Training	CSTARI, Kolkata-91	Member
3.	K. Srinivasa Rao, Joint Director of Training	CSTARI, Kolkata-91	Member
4.	L.K. Mukherjee, Deputy Director of Training	CSTARI, Kolkata-91	Member
5.	Ashoke Rarhi, Deputy Director of Training	ATI-EPI, Dehradun	Member
6.	N. Nath, Assistant Director of Training	CSTARI, Kolkata-91	Member
7.	S. Srinivasu, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
8.	Sharanappa, Assistant Director of Training	ATI-EPI, Hyderabad-13	Member
9.	Ramakrishne Gowda, Assistant Director of Training	FTI, Bangalore	Member
10.	Goutam Das Modak, Assistant Director of Trg./Principal	RVTI, Kolkata-91	Member
11.	Venketesh. Ch. , Principal	Govt. ITI, Dollygunj, Andaman & Nicobar Island	Member
12.	A.K. Ghate, Training Officer	ATI, Mumbai	Member
13.	V.B. Zumbre, Training Officer	ATI, Mumbai	Member
14.	P.M. Radhakrishna pillai, Training Officer	CTI, Chennai-32	Member
15.	A.Jayaraman, Training officer	CTI Chennai-32,	Member
16.	S. Bandyopadhyay, Training Officer	ATI, Kanpur	Member
17.	Suriya Kumari .K , Training Officer	RVTI, Kolkata-91	Member
18.	R.K. Bhattacharyya, Training Officer	RVTI, Trivandrum	Member
19.	Vijay Kumar, Training Officer	ATI, Ludhiana	Member
20.	Anil Kumar, Training Officer	ATI, Ludhiana	Member
21.	Sunil M.K. Training Officer	ATI, Kolkata	Member
22.	Devender, Training Officer	ATI, Kolkata	Member
23.	R. N. Manna, Training Officer	CSTARI, Kolkata-91	Member
24.	Mrs. S. Das, Training Officer	CSTARI, Kolkata-91	Member
25.	Jyoti Balwani, Training Officer	RVTI, Kolkata-91	Member
26.	Pragna H. Ravat, Training Officer	RVTI, Kolkata-91	Member
27.	Sarbojit Neogi, Vocational Instructor	RVTI, Kolkata-91	Member
28.	Nilotpal Saha, Vocational Instructor	I.T.I., Berhampore, Murshidabad, (W.B.)	Member
29.	Vijay Kumar, Data Entry Operator	RVTI, Kolkata-91	Member

GENERAL INFORMATION

1. Name of the Trade : MACHINIST
2. N.C.O. Code No. : 835.10
3. Duration : 2 Years (4 Semesters having duration of six months each)
4. Power norms : 18.32 KW
5. Space norms : 120 Sq.mt.
6. Entry Qualification : Passed 10th Class Examination
7. Unit Size (No. of Student) : 12
- 8a. Instructor's/Trainer's Qualification : Degree in Mechanical Engineering from recognized Engineering college/university with one year experience in the relevant field
- OR
- Diploma in Mechanical Engineering from recognized board of technical education with two years experience in the relevant field
- OR
- 10th Class Pass + NTC/NAC in the Trade of "Machinist"
With 3 years post qualification experience in the relevant field.
- 8b. Desirable qualification : Preference will be given to a candidate with CIC (Craft Instructor Certificate).

Note: At least one Instructor must have Degree/Diploma in Mechanical Engineering.

Syllabus for the Trade of “Machinist”
Under Craftsman Training Scheme

First Semester
(Semester Code no. MCN - 01)
Duration : Six Month

Week No.	Practical Work	Trade Theory	Engineering Drawing	Vocational Science & Calculation
1	2	3	4	5
1	<p>Induction Training:- Familiarization with the Industrial Training Institute importance of trades as per industrial growth and various types of machines used including general safety related to each machines.</p> <p>Demonstration on using fire fighting equipment.</p>	<p>Importance of House-keeping surrounding environment of shop needs and safety to be observed - personnel, machines and housekeeping. Various types of medical facilities provided and nearest hospitals.</p> <p>Occupational Safety & Health</p> <p>Basic safety introduction, Personal protection:- Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution & personal safety message. Use of Fire extinguishers. Visit & observation of sections.</p>	<p>Reading of simple drawing, Engineering drawing & its importance and instruments used in drawing.</p>	<p>Simple arithmetic, Addition, subtraction Multiplication, Division of whole and partial number.</p>
2	<p>Introduction to basic tools:- (i) Hand tools (ii) Fitting tools (iii) Measuring tools.</p>	<p>Hand tools and its importance, steel rule, Try square, chisel, surface gauge and care & maintenance, Hacksaw frame, blades.</p>	<p>Reading of simple drawing, Engineering drawing & its importance and instruments used in drawing.</p>	-Do-

3	Chipping flat surfaces and grinding various angles to chisels, filing flat surface. Grooving with Hammer and chisel.	Classification and types of chisels, files & uses, vices - its constructions and uses. Hammers and its types. Related safety.	a. Making of Title blocks as per IS: 465-1988. b. Various sizes of drawing sheets. c. Various types of pencils & sharpening methods. d. Types of lines & their application as per IS:465:1988.	Properties of metals and their importance in trade.
4	Filing Flat surfaces, Uses of marking tools, Punch, Try square & basic measuring tools, caliper, steel rule.	Marking block, Steel rule, and calipers-different types and uses. Combination set-its components and uses.	-do-	-do-
5	Filing flat surfaces, checking with steel rule and Try square. Hack sawing.	Hacksaw blade, Hacksaw frame and its types. Drill bits- parts, Types & uses.	Use of drawing tools simple geometrical construction.	Fraction & decimals, conversion of fraction to decimals and vice-versa.
6	Marking and Drilling holes on flat pieces. Tapping as per simple drawing.	Introduction to Hand Taps & Dies and their types, applications, care and maintenance. Familiar with tap and drill size, Thread Terminology.	Geometrical construction, regular polygon circles.	Properties of C.I.& its types, uses. Properties of Non-ferrous metals and its identifications.
7	Filing Tee shape job.	Forging tools, its importance and types such as tongs, swage block, anvil etc.	Geometrical construction of polygon inscribed circles.	Properties of copper, Zinc, mild steel, aluminium etc.
8	Filing flat type polygon.	Heat treatment process Annealing, Normalising, Tempering, Hardening, case hardening and its importance. Use of vernier caliper and its parts, construction, principle & reading, use & care.	Curves and types of curves & their application and method of drawing curves.	Physical properties of Brass, Steel, bearing metals, etc.
9	Fitting male and female square piece to close limit. Application of vernier caliper in making job.	Outside micrometer, its types and construction, parts, reading use, care and maintenance.	Geometrical construction, cycloid, hyperbola, Parabola curves, Ellipse, involutes curves.	Decimals, Division, Multiplication.

10	Fitting male and female square piece to close limit. Application of vernier caliper in making job.	Study about Depth gauge, micrometers and dial test indicator - their parts and construction.	Free hand sketch of lines, polygons, ellipse etc.	Logarithm and how to find out mantissa & characteristics. Properties of C.I. steel.
11	Quarterly Revision and Test	Revision and Test	Revision and Test	Revision and Test
12	Introduction to Shaping machine and its construction. Setting of strokes, tools, job on table machining of Rectangular block, steps, with the use of Basic tools. Safety points to be observed while working on a shaper.	Introduction of shaper, types classification, General principles of power transmission on shaping mechanism.	Free hand sketch of basic tools and simple geometrical const. Cone, pyramid, frustum, prisms, sphere etc.	Work, power, energy.
13	-do- Setting of vice, setting of block on vice checking accuracy	Shaping parts, construction use of parts, quick return mechanism ratio etc.	-do-	Motion, velocity and related problems.
14	Shaping Hexagonal, Rectangular block as per sketch checking with caliper & steel rule, angle protractor.	Various tools of shaping machine and their angles and importance of angles.	Construction of scale diagram, division of odd parts of scale with drawing instruments by sketch.	Volume, mass, density and related problems.
15	Shaping "V" blocks with slides, measurement of 'V' groove with vernier bevel protractor, measurement of slots by vernier caliper with 0.02 mm accuracy.	Various methods of holding jobs, use of clamps, nuts & bolts V-blocks, angle plates shaping operations, their importance.	Letters and its types and drawing of letters.	Properties of metals and their applications.
16	Shaping Tee slots, shaping angular surfaces, shaping concave & convex surface with use of tee slot tools, form tools.	Tool head - its parts and application, function of each part of tool head.	Methods of drawing ellipse. How to draw by drawing instruments.	Square roots, power, conversion of decimal to Fraction & vice versa.
17	1. Cutting of external keyway on shaper. 2. Shaping block.	Shaping tools and types. Speed, feed, depth of cut. Surface finish as per ISI system.	Simple dimensions with techniques and location of parts as per dimensions, angle, taper.	Square roots, power conversion of decimal to Fraction and vice versa.

18	Revision and Test.	Revision & Test.	Transforming of various measurements, linear, Angular, Circular etc. Revision and Test.	Multiplication power root of a number. Revision and Test.
19	General introduction to slotting. Safety points to be observed while working on a slotter.	Slotter-principle, construction, details, driving mechanism, quick return motion and speed ratio. Safety precaution comparative study with a shaping machine. Classification of slotting machine.	Freehand sketches of trade related hand tools cutting tools, measuring tools.	Ratio and proportions, Ratio, finding forms and ratio proportions direct and indirect proportions.
20	Slotting a rectangular job checking and measuring with gauges & precision measuring instruments.	-do-	-do-	Application of ratio and proportion to shop problems.
21	Slotting a rectangular job checking & measuring with gauges and precision measuring instruments.	Job holding devices-vice, clamps, V-block, parallel block etc.	-do-	Mixed direct and indirect proportion problems.
22	Slotting square and hexagon internal and external. Slotting a double ended spanner.	Slotting tools different types of work tool angles comparison of tool shape with that of shaper.	Free hand sketches of trades related hand tools, measuring tools.	Machines-basic principles, velocity ratio, mechanical advantage, efficiency. Related simple problems.
23	Practice on slotting key ways on pulley-Internal and external slotting irregular shaped jobs having curved surfaces.	Use of tool with holder for internal operations. Precautions to be observed during slotting internal operations.	Orthographic drawings application of both first angle and third angle methods in representing the drawing for simple & complex machine blocks given for exercises with dimensions.	Algebraic symbols & fundamental algebraic operations signs & symbols used in algebra, co-efficient, terms like terms & unlike terms.

24	-do- Slotting internal operations. Slotting concave and convex surfaces.	Introduction to coolant & lubricant-difference between them, types and uses of each. Use of circular marks on the table for slotting curves.	-do- Orthographic drawings application of both first angle & third angle. Methods in representing the drawings for simple and complex machine blocks given for exercises with dimensions.	Addition, subtraction, multiplication and division. Logarithm & Antilogarithm. Problems on logarithms.
25	(i) Project Work (ii) Industrial Visit (Optional)			
26	Examination			

**Syllabus for the Trade of “Machinist”
Under Craftsman Training Scheme**

**Second Semester
(Semester Code no. MCN - 02)
Duration : Six Month**

Week No.	Trade Practical	Trade Theory	Engineering drawing	Vocational Science & calculation
01	Introduction of planning machines, Adjustment of stroke, setting of tool, vice on planer table machining of rectangular block on planer. Safety points to be observed while working on a planer.	Introduction to Planning M/c. parts, types, constructions, details of Driving mechanism of planer, quick return motion etc.	Pictorial drawing. Isometric drawings of simple block.	Problems on work, power & energy.
02	Planning angular, Horizontal, vertical operations, planning Dovetail.	Tool head of planer its construction and various function of each part v-block, clamps, bolts, step block and other holding devices.	-do-	-do-
03	Planning of various key ways (open & blind). Types of operation, concave & convex surface i.e. goose neck clamp.	Cutting tools for Planner - their material and types. Templates, gauges, their fixtures and vices.	Oblique views of simple geometrical constructions.	Ratio & percentages and related problems.

04	Planning V Block machining of planer gauge.	Hydraulic mechanism of planer their advantages, disadvantages.	Isometric drawing of completed jobs.	Meaning of stress, strain, elasticity, tensile properties.
05	Planning male & female dovetail, grinding of tools, checking with Vernier bevel protractor & roller methods.	Dovetail measurement external and internal by vernier bevel protractor.	Isometric drawing of simple blocks.	-do-
06	-do-	Checking of Dovetail by roller method.	-do-	Meaning of stress, strain, elasticity, tensile properties.
07	Revision and Test.	Revision and Test.	Revision and Test.	Stress and its important factors example. Revision and Test.
08	Introduction to an engine lathe. Holding of round job in an independent chuck and truing it. Holding the tool in a tool post, centering the job with the tool. Facing & drilling.	Introduction to lathe. Its types, engine lathe construction, detail function of parts size and specification. Safety points to be observed while working on a lathe.	Standard method of sectioning as per IS-696. Exercises for different sectional views on the given orthographic drawing of machine parts, castings etc.	Simple machines like winch pulley & compound axle etc. with examples.
09	Parallel turning between centers, parting off, chamfering using roughing, finishing and parting off tools.	Lathe tools their angles & uses. Driving mechanism, speed and feed mechanism & lathe accessories.	Standard method of sectioning as per IS-696. Exercises for different sectional views on the given orthographic drawing of machine parts, castings etc.	Factors and equations of algebraic formula.
10	Holding the job in three jaw chuck truing, centering facing. Step turning undercutting, knurling drilling and boring.	Chucks-different types of job holding devices on lathe and advantages of each type. Mounting and dismounting of chucks.	-do-	Factors and equations types of factorizations.

11	Taper turning by offset method checking of the taper with precision instruments. Taper turning by swiveling compound rest, setting the compound rest to correct degree, checking the tool height, clamping the saddle for no longitudinal movement, checking up with precision instruments.	Taper introduction, types and uses. Calculations of tapers. Measurement of taper by sine bar and slip gauges.	-do-	standards and measurements equations simple simultaneous quadratic equations. Atmospheric pressure, pressure-gauge, gauge pressure & absolute pressure.
12 & 13	Cutting V thread external and internal in a lathe. Checking up with screw pitch gauge. Cutting square thread external & internal on a lathe.	Different thread forms their related dimensions and calculations screw cutting in a lathe. Measurement of threads by three wire methods.	Inter conversion of Isometric to orthographic drawings and vice-versa. Related problems such as V blocks-simple stepped blocks, block oriented by various machining operations etc.	Application-construction and solution of problem by equations.
14	Introduction to milling machine, demonstration on working principle, setting of job, setting of cutter in arbor, setting of vice on table. Safety points to be observed while working on a milling machine.	Milling machine importance of milling machine, types and specification of milling machine, driving and feed mechanism of milling machine.	Inter conversion of isometric, oblique drawings to orthographic drawings and vice-versa. Related problems such as V blocks, simple stepped blocks, block oriented by various machining operations etc.	Power & introduction to exponent & laws of exponent.
15	Sequence of milling six faces of a solid block. Checking the accuracy with the help of try-square scribing block and vernier height gauge.	Classification & different types of milling cutters & their use. Parts and nomenclature.	-do-	-do-

16	Step milling using side and face cutter checking with micrometer.	Vernier height gauge construction, graduations vernier setting & reading, vernier bevel protractor, construction graduation setting and reading. Care and maintenance of vernier height gauge and bevel protractor.	Free hand sketch of sectional tools.	Arithmetical operations involving logarithms in the computations.
17	Straddle and gang milling operations including up-milling and down milling.	Different milling operations plain-face, angular, form, slot, gang and straddle milling etc. Up and down milling.	Inter conversion of isometric, oblique drawing to orthographic drawings and vice-versa. Related problems such as V block simple stepped blocks, blocks oriented by various machining operations.	Problems related to trade using logarithm tables.
18	Milling concave and convex surfaces.	Different types of milling attachments and their uses.	Surface development of simple geometrical solids like cube, rectangular block, cone, pyramid, cylinder, prism etc.	Density of solid and liquids-related simple problems.
19	Introduction to indexing head types, setting and aligning of indexing head with reference to job on milling machine.	Indexing-introduction & types. Indexing head-constructional details, function of indexing plates and the sector arms. Calculation for various types of indexing.	-do-	Specific gravity principle of Archemedics.
20	Milling square and hexagonal job by simple indexing method.	-do-	-do-	Relation between specific gravity and density. Related simple problems.
21	Milling dovetail and 'T'slots both male and female matching each other. Milling Rack of straight teeth.	Gear introduction, use and type. Elements of a spur gear. Gear tooth of each forms types, merits and demerits of each. Spur gear calculations, curves and their uses.	Interpenetration of solids and conventional application of intersectional curves on drawings.	Geometry - Fundamental geometrical definitions angles and properties of angles, triangles and properties of triangles.
22	Milling of spur gear having even and odd number of teeth.	Selection of gear cutter type and form & various methods of checking gear and its parts.	-do- Free hand sketches/drawing of gear tooth.	Pythagoras theorem, properties of similar triangles.

23-24	Introduction to grinding machine surface grinder, cylindrical grinder. Driving and feed mechanism, job holding devices mounting of wheels. Wheel balancing & truing. Grinding of parallel and stepped jobs. Dressing of grinding wheels.	Grinding machine introduction types, specification, their parts and functions & uses. Safety points to be observed while working on a Grinding machine. Types of Abrasives and their uses, Glazing and loading of wheels. Explain the importance and necessity of quality.	Solution of NCVT Test Paper (Preliminary)	Solution of NCVT Test Paper (Preliminary)
25	(i) Project Work (ii) Industrial Visit (Optional)			
26	Examination			

**Syllabus for the Trade of “Machinist”
Under Craftsman Training Scheme**

**Third Semester
(Semester Code no. MCN - 03)
Duration : Six Month**

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Vocational Science & calculation
01	Checking of alignment of lathe centers and their adjustments. Center drilling, step turning between centers recessing and chamfering & measurement with vernier caliper. Taper turning by taper turning attachment.	Turning of taper by taper turning attachment advantages and disadvantages taper calculations.	Revision of 1 st Year topics.	Revision of 1 st Year topics.
02	Cutting square threads (left & right hand) on a lathe-checking with thread gauge-grinding of tool and setting in correct position.	Screw cutting on a lathe. Terms relating screw thread major/ minor diameter pitch and lead of the screw, depth of thread simple gear train and compound gear train change gears for fractional pitches.	Revision of 1 st Year topics.	Revision of 1 st Year topics.

03	1. Cutting multi-start V thread on lathe. 2. Cutting key way broaches.	Difference between single and multi-start threads-their uses merits and demerits. Broach - its types and uses.	Screw thread their standard forms as per I.S external and internal thread conventions on the features for drawings as per I.S.I.	Rectangle, square Rhombus, parallelograms etc. and their properties.
04	Cutting ACME threads (Male and female) on a lathe. Lead screw.	Square thread its form and calculation of depth, core dia, pitch dia. Acme thread its forms use and calculations.	-do-	Circle and properties of circle. Regular polygon.
05	Cutting acme threads on lathe (Male and female).	Square threads-its forms and calculations of depth, core dia, pitch dia, Acme threads-its forms, use and calculations.	Sketches for bolts, nuts, screw and other screw screwed members.	Application of geometry to shop problems.
06	Turning of irregular jobs using face plate.	Face plate- its construction safety precaution in holding jobs on face plate.	-do-	Heat & Temperature thermometric scales their conversions.
07	Exercise on use of pillar drill in drilling, counter sinking, counter boring. Spot facing and use of spot facing tools.	Pillar drill machine constructional details, functions of parts. Application of pillar drill.	Standard rivet forms as per ISI	Temperature measuring instruments.
08	Further practice of drilling of Radial drills. Practice of reaming on drilled holes.	Radial drills function parts etc. Reamer- parts, types, uses.	-do-	-do- co-efficient of expansion and related calculations.
09	Shaping key way on gears and pulley blocks.	Special tools – use and precautions to be observed for shaping internal keyways dovetails & ‘T’ slots.	Riveted joints- Different types.	Quantity of specific heat of solids, liquids & gases.
10	‘T’ slots cutting in shaping machine.	Various material for single point cutting tools, tipped tools, their brazing and grinding process. Tool angles and their effect on cutting various materials.	Riveted joints- Different types.	Heat loss and heat gain with simple problem.
11	Cross Dovetail cutting on shaper.	Cutting speed, feed, depth of cut for slotting, shaping and time calculation.	Sketches of keys, cotter & pin joints.	Mensurations, plain figures-triangles, square, rectangles, parallelogram.
12	Shaping cross dovetails mating jobs male and female.	Checking of dovetail grooves with vernier caliper and roller. Their calculations and use of sine bar, slip gauge and dial test indicator.	Sketches of keys, cotter & pin joints.	Plain figures trapezium, regular polygons, circle hollow circles.

13	Shaping of casting jobs, using angle plate, jack and clamps. Machining of irregular shaped intricate casting.	Properties of metals general idea of physical, mechanical properties of metals, colour, weight, hardness toughness, malleability, ductility their effect on machine ability.	Sketches for simple pipe unions with simple pipe line drawings.	Plain figures segment and sector of circle, ellipse fillets.
14	Grinding of form tools and shaping of convex and concave surfaces.	Use of radius gauges and template. Introduction to jigs and fixtures. Types and uses.	-do-	Solid figures prism, cylinder, pyramid, cone.
15	Machining of curves on a slotting machine. Slotting of a double ended spanner.	Interchangeability – Limit, Fit, Tolerances and allowances.	Concept of assembly drawing and detailing simple assembly and their details of trade related tools/jobs/ exercises with dimensions from the given sample or model. Tool post for the lathe with screw and washer. Concept of assembly drawing and detailing. Simple assemblies and their details of trade related tools/jobs/ exercises with the dimensions from the given sample or models. Tool post for the lathe with washer and screw.	Solid figures- Frustum of cone sphere, spherical segment. Material weight and cost problems related to trade.
16	-do- Slotting internal & external operations.	-do-	-do- Free hand sketches of V-blocks with clamps.	Trigonometry, Trigonometrical ratios use of trigonometric table.
17	Machining of internal spline and external spline on slotter uses to match each other.	Introduction and their indexing process on a slotter by its rotary table graduations.	Details and assembly of V-blocks with clamps.	Area of triangle by trigonometry.
18	Cutting external and internal spur gear on slotter use of rotary table.	Form tool for slotting machines. Calculation for spur gear in relation to graduation of circular table.	Detail assembly of shaft and pulleys.	Finding height and distance by trigonometry.
19	Slotting regular & irregular job and contours and sprockets.	Calculation for cutting sprocket.	-do-	Application of trigonometry to shop problems.

20	Planning long jobs having 'T' slots and dovetails grooves.	Tool setting for dovetail use of relevant tool and their grinding process. Alignment of long jobs with precision instruments.	Details and assembly of a simple hand vice.	Application of trigonometry to shop problems.
21	-do-	-do-	-do-	Triangle of forces. Parallelogram of forces.
22	Setting and planning no. of casting jobs at a time.	Hydraulic transmission in machine tool- its advantages and application hydraulic system of a planer. Use of planer gauge for setting tool and template for profile checking.	-do-	Composition and resolution of forces.
23	Marking fabricated jobs & machining on a planer.	-do-	-do-	-do-
24	Demonstration of marking system of Grinding wheels. Different Tool and Cutter grinding practice on Tool & Cutter grinding m/c. Milling tongue and groove on a mating job. Checking with precision instruments and gauges.	Selection procedure of grinding wheels. Abrasives its types Bonds, Grade Grit, structure, different shapes of wheels and their uses. Inside micrometer, Principle, construction graduation reading both in English and metric system gauge-types and uses.	-do- Details and assembly of bush bearing	Representation of forces by vectors. Simple problem on lifting tackles like jib cranes, wall cranes and solution of problem with the aid of vectors.
25	(i) Project Work (ii) Industrial Visit (Optional)			
26	Examination			

Syllabus for the Trade of "Machinist"
Under Craftsman Training Scheme

Fourth Semester
(Semester Code no. MCN - 04)
Duration : Six Month

Week No.	Trade Practical	Trade Theory	Engineering Drawing	Vocational Science & calculation
01	Milling cylindrical cutter.	Spiral introduction, type and elements. Difference between helix & spiral. Difference between R.H. and L.H. helix.	Types of curves. How to draw. Free hand sketches of different types of cams.	-do-
02	Milling end mill/drum cam.	Spiral-lead, helix angle and calculation.	Details and assembly of simple coupling.	Simple problems on strength and crank lever.

03	Cutting reamer on milling m/c.	Reamer Calculation & off-setting	-do-	Centre of gravity simple experimental determination stable unstable and neutral equilibrium simple explanation.
04	Milling Drill	Cam Introduction development and use.	Blue print reading simple exercises related to missing lines.	Friction co-efficient of friction.
05	Cutting face cam.	Use of proper cutting speed and feed for various metals. Calculation for the machining time, machining allowances. Lubricant/coolants and various ways of their application.	-do-	Simple problem related to friction.
06	Cutting a plate cam with angular setting	Cam-lobe, lead setting of dividing head, Calculation.	Blue print reading simple exercises related to missing views.	Magnetic substances natural and artificial magnets.
07	Boring a casting job in a vertical milling machine.	Vertical milling machine its parts, construction, method of boring in a vertical milling. Difference between horizontal and vertical milling machine.	-do-	Basic principle of electricity. Method of magnetization & uses of magnets.
08	Milling gears by differential indexing, Measuring the teeth with a vernier gear tooth caliper.	Vernier gear tooth caliper, its construction and application in checking gear tooth.	Simple exercises related to missing symbols	Basic principle of electricity.
09	Milling hexagonal hole on a plate by attachment.	Elements of milling cutter Rake angle, primary, secondary and clearance angles, lead etc.	-do-	Use of fuses, conductors switches, insulator etc.
10	Milling spline (external) Milling straight fluted Reamer.	Introduction to broaching methods of milling splines. Its calculations and selection of cutters.	Simple exercises related to missing lines.	Simple electric circuits. Simple calculations.
11	Milling a helical groove in a vertical milling machine. Milling a slab mill cutter. Milling twist drill.	Spiral milling lead, pitch, helix angle R.H. and L.H. swiveling the table in relation to the helix angle, selection of cutter for spiral milling. Calculations for spiral milling.	-do-	Ohm's law simple calculations electrical insulating materials.

12	Milling a helical groove in a vertical milling machine. Mill a slab mill cutter.	Helical gear introduction elements and calculation. Introduction geometry and uses of bevel gears.	Simple exercises to missing dimensions.	Graphs Abscissa & ordinates, graphs of straight line, related to 2 sets of varying quantities.
13	Milling helical gears. Cutting bevel gears on a milling machine by using bevel gear cutter.	Quality control types of variation, causes of variation, measurement of testing, gear & error.	Hand drawing for indicating switches, buttons controls m/c. tool excess quadrant point value.	-do-
14	Milling a rack. Milling face cam.	Introduction to rack, its use & application. Rack cutting attachment, calculation for linear pitch, circular pitch, Gear ratio, Indexing movement, etc.	Solution of NCVT Test Paper.	Further practice on logarithm. Shop problems on estimation of material, time taken for machining a job elementary time and motion study.
15	Cutting worm and worm wheel on a milling machine, gashing and finishing.	Introduction, geometry and use of worm and worm wheel.	-do-	Shop problems on estimation of material, time taken for machining a job, elementary time and energy.
16	-do-	Cam-types, application in modern m/c. tools, its special advantages, manufacturing process, calculation for milling a drum cam.	-do-	Transmission of power by belt pulley and gear drive.
17 & 18	Graduations of steel rule on milling machine. Use of tolly cutter. Milling a drum cam. Milling a plate cam.	Reamers, types and uses of reamer milling calculations angles of cutter, no of teeth, increment lead, gear ratio depth of cut etc. selection, setting of cutter. End mill cutter types and uses, calculations, angle of cutter, depth of cut, backing off etc. Advantages of helical teeth over straight teeth. Life of a milling cutter.	-do-	-do- Solution of NCVT papers.

19 & 20	Milling a spiral reamer, milling an end mill cutter with helical teeth. Milling side and face cutter (straight teeth).	Side and face cutter types and uses. Its calculation setting of the job for cutting teeth on the face and at the side tilting of single angle cutter for giving backing. Angle form cutters calculations specifications No. of teeth, bore size, outside dia, angles etc.	Revision	-do-
21 & 22	Milling angle form cutters.	Introduction to CNC Technology CNC M/c. principle advantages classification, drives, controls.	CNC part programming manual part programming.	Revision.
23	Simple programme and operating CNC M/c.	Basic information on CNC machine & maintenance of CNC M/c. computer aided CNC Language.	Preparation of processing instructions. Solution of CNC problems.	Revision.
24	Contouring on CNC machine.	Surface finishing necessity and different processes. Non Traditional machining process. Introduction, classification. Different processes and uses.	Solution of CNC problems.	Revision.
25	Revision			
26	Examination			

Trade: Machinist

Tools and Equipments for 12 trainees + one (for Instructor)

A : Trainees kit

Sl. No.	Description	Qty
1	Steel rule 30 cm graduated both in English & Metric units	13 nos
2	Outside spring caliper 150 mm	7 nos.
3	Inside spring caliper 150 mm	7 nos.
4	Hermaphrodite caliper 150 mm	7 nos.
5	Divider spring 150 mm	7 nos.
6	Centre Punch 100 mm	7 nos.
7	Hammer B.P. 0.5 kg.	13 nos.
8	Cold chisel flat 25 x 200 mm	13 nos.
9	File flat bastard 300 mm	13 nos.
10	File flat 2 nd cut 250 mm	13 nos.
11	File flat smooth 200 mm	13 nos.
12	Engineers screw driver	13 nos.
13	Combination Plier 150 mm	13 pairs
14	Safety glasses	13 nos.

B: Tools, Instruments and General Shop Out fits

15	Surface plate 400 mm x 400mm grade	1 no.
16	Table for surface plate 900 x 900 x 1200 mm	1 no.
17	Marking off table 1200 x 1200 x 900 mm high	1 no.
18	Scribing block universal 300 mm	2 nos
19	V- Block 100/7 – 80 – A	2 nos
20	Try square 300 mm	2 nos
21	Outside spring caliper 200 mm	2 nos
22	Divider spring 200 mm	2 nos
23	Inside spring caliper 200 mm	2 no.
24	Straight edge steel 1 meter	1 no.
25	Straight edge steel 500 mm	1 no.
26	Steel tape 2 meter in case	1 no
27	Steel rule 60 cm graduated both in English & Metric units	2 nos
28	Sprit level 2V 250, 05 meter	1no
29	Hammer B.P. 800 gms. With handle	4 nos
30	Screw driver, heavy duty 300 mm with handle	4 nos
31	Hammer lead 1 kg.	2 nos
32	Spindle blade screw driver 100 mm	4 nos
33	Allen Hexagonal keys 2.5 to 12	2 sets
34	Spanner D.E. series 2 (set of 7 pieces)	6 sets
35	Adjustable spanner 300 mm	2 nos
36	Reduction sleeve Morse 1-1, 3-1, 4-1, 4-2, 5-1, 5-2, 6-1,	2 nos each
37	Angle plate size 200 x 100 x 200 mm	2 nos
38	Angle plate adjustable 250 x 150 x 175 mm	2 nos
39	Solid parallels in pairs (different sizes) in Metric	12 pairs (assorted)
40	Oil Can pressure feed 500 mg.	6nos
41	Oil stone 150 x 50 x 25 mm	2nos
42	Number drills H.S.S. (parallel shank)	1set
43	Twist drills 3 mm to 13 mm in step of 0.5 mm (parallel shank)	2set
44	Drill Chuck 0.20 with taper shank	1no
45	Centre drill A 1 to 5	2set
46	Grinding wheel dresser (diamond)	1no
47	Grinding wheel dresser huntington type	2 nos.
48	Clamps C 100 mm	2nos
49	Clamps C 200 mm	2nos
50	Tap and Die set in box metric pitch (6 mm to 12 mm)	1set
51	Drill H.S.S. taper shank (6 mm to 12 mm in step of 0.5 mm)	2set
52	File flat 2 nd cut 250 mm	4nos

53	File flat smooth 200 mm	4nos
54	File Half round 2 nd cut 250 mm	4nos
55	File triangular smooth 200 mm	4nos
56	Needle file set	1no.
57	File square 2 nd cut 250 mm	4nos
58	Reamer 6 mm to 25 mm by 1 mm	1set
59	Reamer adjustable 10 mm to 15 mm by 75 mm	1set
60	Tool bits H.S.S. 6 mm square	1 Dozen
61	Tool bits H.S.S. 10 mm square	1 Dozen
62	Tool bits holder (Armstrong) L.H	4nos
63	Tool bits holder (Armstrong) R.H.	4nos
64	Assorted tools and bit holders for lathe, shaper, slotter & planner in different shapes and sizes	As required
65	Hacksaw frame adjustable 250-300 mm with blades	2nos
66	Table chuck 75 mm jaw swivel base	1no
67	Machine vice 200 mm swivel base	4nos
68	Machine vice 160 mm swivel base	2nos
69	Hand vice 50 mm jaw	2nos
70	Radius turning attachment	1no
71	Angle turning attachment	1no
72	Compound angle vice (standard sine)	1no
73	Universal vice 150 mm	1no
74	Universal table angle plate	1no
75	Shaper tool holder turret type	2nos
76	Base chuck for slotter	1no
77	shaper indexing center	1no
78	Knurling tools (set of 3) straight and diamond	1each
79	Plier cutting 200 mm	2nos
80	Carbide tipped tools of different sizes and shapes (throw away tips)	2sets
81	Hand hammer 1 kg. With handle	2nos

C : Milling Cutters

Sl No.	Name & Description of Cutters	Quantity
1	Cylindrical cutter 63 x 90 bore dia	3nos
2	Cylindrical cutter 80 x 90 bore dia.	3 nos
3	Side and face cutter dia 80 x 8	2 nos
4	Side and face cutter dia 160 x 10	3 nos
5	Side and face cutter dia 100 x 12	2 nos
6	Side and face cutter dia 160 x 16	2 nos
7	Side and face cutter dia 200 x 20	3 nos

8	Side and face cutter dia 100 x 10	2 nos
9	Equal angle cutter 45 ⁰ /100	2 nos
10	Equal angle cutter 60 ⁰ /100	2 nos
11	Equal angle cutter 90 ⁰ /100	2 nos
12	Double angle unequal cutter 50 x 12 x 55 ⁰	2 nos
13	Double angle unequal cutter 50 x 12 x 60 ⁰	2 nos
14	Double angle unequal cutter 50 x 12 x 70 ⁰	2 nos
15	Double angle unequal cutter 50 x 12 x 75 ⁰	1 no
16	Single angle cutter 63 x 18 x 45 ⁰ RH	1 no
17	Single angle cutter 63 x 18 x 45 ⁰ LH	1 no
18	Single angle cutter 63 x 18 x 60 ⁰ RH	1 no
19	Single angle cutter 63 x 18 x 60 ⁰ LH	1 no
20	Slitting Saw cutter Ø 75 x 3 X Ø 27 mm	2 nos.
21	Slitting Saw cutter Ø 100 x 6 X Ø 27 mm	2 nos.
22	Shell End Mill Ø 50 x 36 x Ø 22 (preferably inserted tip type)	2 nos.
23	Shell End Mill Ø 75 mm x 50 x Ø 22 (preferably inserted tip type)	2 nos.
24	Parallel shank end mills Ø6, Ø10 and Ø 16 are (double fluted), Ø 20 mm & Ø 25mm (four fluted)	4 nos. each
25	'T' slot cutter with parallel shank- Ø 17.5 x 8 mm width x dia. of shank 8 mm	2 nos.
26	Concave Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
27	Convex Milling cutter Ø 63 x 6 radius x Ø 27 mm	1 nos.
28	Disc type form milling cutter (involute form -2 module, 20° pressure angle)	1 set

D : MEASURING INSTRUMENTS

Sl No.	Name & Description of Instruments	Quantity
1	Micrometer outside 0-25 mm	4 nos
2	Micrometer outside 25-50 mm	2 no
3	Micrometer outside 50-75 mm	1 no
4	Micrometer depth gauge 0-200 mm	1no
5	Digital micrometer 0-25 mm	1 no
6	Direct reading vernier caliper 0- 300 (direct reading with dial)	1no
7	Digital vernier caliper 0- 300 mm	1 no
8	Vernier height gauge 250 mm	1 no
9	Vernier gear tooth caliper	1no
10	Combination set with 300 mm rule	2 sets
11	Vernier bevel protractor with 150 m blade	1 no
12	Bevel gauge 200 mm	1 no
13	Telescopic gauge 13 mm to 300 mm	1set

14	Sine Bar 200 mm	1 no
15	Dial test indicator with magnetic gauge type 1 grade A with magnetic base	1 no
16	Center gauge 60 ⁰	1 no
17	Slip gauge set (normal set) metric (for the whole institute)	1 set
18	Screw pitch for metric pitches (25-6 mm)	2 sets
19	Radius gauge metric set (1-6 mm)	1 set
20	Limit plug gauges 5 mm to 25 mm by 2.5 mm	1 set
21	Ring gauges 5 mm to 25 m by 2.5 mm (GO & NO GO)	1 set
22	Taper gauge M.T. No. 1, 2, 3, 4 & 5	1 set
23	Feeler gauge	1 no
24	Planer gauge standard size	1 no
25	Magnifying glass 75 mm	2nos

E : FURNITURE

Sl No.	Name & Description	Quantity
1	Steel lockers for 12 trainees	1no
2	Steel chair for Instructor	1 no
3	Steel table for Instructor	1 no
4	Work bench for Fitters with 2 vices of 100 mm jaw	1no
5	Steel cup board 180 x 90 x 45 mm	1 no
6	Steel cup board 120 x 60 x 45 cm	1no
7	Black board with easel	1 no
8	First Aid Box	1 no

F : General Machinery Shop outfit

Sl No.	Name & Description of Machine	Quantity
1	Shaping machine 450 mm stroke (motorized) with all attachments	2 nos
2	Shaping machine 315 mm stroke (hydraulic) with all attachments	1 no
3	Double column planer 1500 x 1000 x 1000 (motorized) with all attachments	1no
4	Slotter 180 mm stroke (motorized) with all attachments	1no
5	Lathe general purposes all geared height of centers 150 mm to below Between centers 150 mm supplied with jaw and 4 jaw chuck, face plate, Taper turning attachment, steadies etc. and set of lathe tools	3 nos.
6	Tool and cutter grinder 250 mm to admit 450 m between center-fully motorized work head supplied with tool rest of different types table clamps and other attachments.	1 no

7	Drilling machine pillar 20 mm capacity	1 no
8	Radial drill 1200 mm area motorized with tapping attachment	1no
9	Silicon carbide grinder for carbide tipped tools	2 sets
10	Double ended Pedestal Grinder with 178 mm wheels(one fine and one rough wheel)	1 no.
11	Milling machine universal horizontal Table Length x width 1350 x 310 mm (motorized) with all attachments such as . a. Universal head b. Vertical head c. Slotting attachment d. Rack cutting attachment e. Rotary table f. Dividing head g. Adaptors, arbors and collects etc. for straight shank and mill from 3 mm to 30 mm	2 nos.
12	Milling machine plain type horizontal Table Length x width 1350 x 310 mm (motorized) with all attachments	1no
13	Milling machine vertical Table Length x width 1350 x 310 mm (motorized) with all attachments	1 no
14	Surface grinding machine wheel dia. 180 mm (or near) reciprocating table, longitudinal table traverse 200 mm (or near) fitted with adjustable traverse stop. Full motorized supplied with magnetic chuck 250 mm x 120 mm diamond tool holder set of spanner, grease gun etc.	1 no
15	Cylindrical grinder Max. grinding length 300 mm Height of centre 130 mm Max. distance between centers 340 mm	1 no
16	CNC milling trainer with all accessories and consumables in duplicate	1 no

NOTE

1. No addition items are required to be provided to the batch working in the second shift except the items under trainees lockers.
2. Items marked @ are not required to be provided for any additional batches.
3. The specification of a number of item, in the list have been given as per I.S. Other items should also be procured according to I.S. specification, if available.
4. Training should be imparted on forging heat treatment by utilizing the existing facilities wherever available.