

DRAFT
Syllabus for the trade
Of
**MECHANIC MACHINE TOOL
MAINTENANCE**
UNDER
Modular pattern
Of
CRAFT INSTRUCTOR TRAINING SCHEME

**TRADE TECHNOLOGY-II
(T T-II)**

Duration:- 3 Months / 13 weeks
Designed in - 2010

Government of India
Ministry of Labour & Employment
Directorate General of Employment and Training
ADVANCED TRAINING INSTITUTE
KOLKATA
DASNAGAR, HOWRAH
WEST BENGAL - 711105

List of member attended the Trade Committee Meeting to finalise the Draft Syllabus for the trade of **Mechanic Machine Tool Maintenance** under Modular Pattern of Craft Instructor Training Scheme of **Trade Technology-II (TT-II)**, held on 26.2.2010, at Advanced Training Institute Kolkata.

SI.NO.	Name & Designation S/Shri/Smt.	Organisation
1.	N. K. CHATTERJEE, DIRECTOR	A.T.I. KOLKATA
2.	J UKIL, JDT	A.T.I.KOLKATA,
3.	S. HARINATH BABU, JDT	A.T.I.CHANNAI
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5.	A. CHAKRABARTI, DDT	APEX HI-TECH INSTUTE, BANGALORE
6.	S. SURYANARAYANA, DDT	A.T.I. HYDERABAD
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8.	BRO. MATHEW.T.V, DIRECTOR	DON BOSCO S.E.R.I. HOWRAH
9.	DR. N. K. SINGH, ASSTT. PROF. (W/S)	INDIAN SCHOOL OF MINES, DHANBAD
10.	SANDIP GHOSH, HEAD – PROJECTS	TATA STEEL PROCESING AND DISTRIBUTION LTD.
11.	PALASH BHOWMIK, DEPUTY MANAGER	NATIONAL SMALL INDUSTRIES CORP.
12.	P. ADHIKARI, FACULTY	THE GEORGE TELEGRAPH TRAINING INSTITUTE, KOLKATA
13.	N. C. DE, D.G.M (HRD)	TEXMACO LTD. KOLKATA
14.	DEBJIT MUKHERJEE, SR. MAINT. ENGG	BRIDGE & ROOF CO.(I)LTD., HOWRAH
15.	ANIL KUMAR DAS, SUPERVISOR	REP. OF GOVT. OF W. B.
16.	LAKSHMI KANTA POLLEY, INSTRUCTOR	DO
17.	SUBRATA POLLEY, INSTRUCTOR	DO
18.	A. K. KARMAKAR, MD	REP. OF CII
19.	S. P. JANA, REP. OF CSAD -PRESIDENT	CENTRAL STAFF ASSOCIATION OF DGET KOLKATA
20.	G. C. SAHA, ADT	A.T.I. KOLKATA
21.	E. MINZ, ADT	A.T.I. KOLKATA
22.	A.K. MANDAL, ADT	A.T.I. KOLKATA
23.	A. K. DUTTA, ADT	A.T.I. KOLKATA
24.	T. V. RAJASEKAR, ADT	A.T.I. CHANNAI
25.	AVINASH S. HEDAOO, ADT	A.T.I.MUMBAI
26.	R. K. CHAKRABORTY, TO	RDAT KOLKATA
27.	SK. ALTAF HOSSAIN, TO	A.T.I. KOLKATA
28.	D. MANDAL, T.O	A.T.I.DASNAGAR
29.	B. N. HEMBRAM, TO	A.T.I.KOLKATA
30.	U. K. SARKAR, VI	A.T.I. KOLKATA
31.	P. K. BAIRAGI, VI	A.T.I. KOLKATA
32.	DINESH KUMAR, V.I	A.T.I. KANPUR
33.	S. GHOSH, SR. D/MAN	A.T.I. KOLKATA

GENERAL INFORMATION

1. Name of the Trade: Mechanic Machine Tool Maintenance

2. N. C. O. Code No. : 845.50

3. Name of the Module : Trade Technology – II

4. Duration : 03 Months

5. Entry Qualification : Candidate who have passed Diploma in relevant branch of Engineering or National Apprenticeship Certificate in the concerned trade or National Trade Certificate with one year Practical Experience in concerned trade.

Note: To get admission in TT – II candidate has to pass TT – I.

COURSE STRUCTURE

Module :- TRADE TECHNOLOGY- II (TT-II)

Sl. No.	Components	Units	Allotted Time/week	Allotted Time/module
1.	Trade Technology	a) Theory	14 hrs/wk	14x13=182hrs
		b) Practical	25hrs/wk	25x13=325hrs
2.	Library	C) Library	1hr/wk	1x13=13hrs
			40hrs. / wk	520 hrs. / module

Duration: 3 Months / 13 Weeks.

OBJECTIVE

THE OBJECTIVE OF THE COURSE IS TO TRAIN INSTRUCTORS USING I.C.T & C.B.T. IN THE TECHNIQUES FOR IMPARTING TRAINING ON LATEST KNOWLEDGE IN THE RELATED TRADE KEEPING IN VIEW OF THE PRESENT AND FUTURE GLOBAL INDUSTRIAL REQUIREMENTS, SO THAT SEMI-SKILLED / SKILLED MAN POWER OF THE COUNTRY MAY BECOME ENABLE TO COMPETE IN THE GLOBAL MARKET.

**SYLLABUS FOR MODULAR PATTERN
OF
CRAFT INSTRUCTOR TRAINING SCHEME
TRADE: MECHANIC MACHINE TOOLS MAINTENANCE
TRADE TECHNOLOGY – II (TT- II)**

Week no.	THEORY	PRACTICAL
1.	<p>Introduction to maintenance work. Importance of maintenance, method and tools used. Safety to be observed in maintenance activities. Importance of good house keeping, cleaning and orderliness and personal hygiene. Introduction to 5S and KAIZEN.</p>	<p>Familiarization with institute and work place. Types of work to be done by the trainees, the role of mechanics and machine tool maintenance in Industries. Rules and regulation of the institute. Allocation of work place, issue of tool box and essential tools. Introduction of First Aids practice - methods of maintaining of First Aid Box.</p>
2.	<p>Concept of routine, preventive and breakdown maintenance. Inspection, diagnosing & repairing procedure. Schedule and planning for preventive maintenance work. Maintenance of records, log book and history sheet. Functions involving preventive maintenance. Advantage of preventive maintenance. Frequency of preventive maintenance, preparing preventive maintenance schedule - points to be considered. Lubrication survey – system of symbols and colour coding. Identification of Lubrication (oil & grease) points. Method of repairing damage parts, Major overhauling, Method of reconditioning of measuring instruments used – special tools, test mandrel, spotling gauges, bridge used – testing of m/c after repair. Preparation of test chart.</p>	<p>Planning of overhauling. Method of dismantling, precaution to be taken while dismantling. Sequence of operation of marking of the parts, Methods of cleaning of parts, Solvent and cleaning materials - their names and specification. Proper method of removal and remounting of bearings. Re-assembling of machine in correct sequence, testing of correct functioning of machines (shaping, milling, lathe, and drill) and coolant pump and lubricating - using various hand tools with specific reference to the functional parts of machine.</p>
3.	<p>Methods employed for installation</p>	<p>Introduction to leveling the</p>

	<p>and erection of precision and heavy duty machines. Location and excavation of foundation. <u>Different types of foundation:</u> Structural, reinforced, wooden and isolated. Requirement of good foundation, different types of foundation & anchor bolts. Foundation for heavy duty machine and precision machine. Special process involving in erection of heavy duty machines. Layout of machines – Consideration of power, space, weight, ventilation and moving parts. Types of vibrators, causes and prevention of vibrations. Method of insulation of machine against vibration. Anti-vibration devices and their locations. Different types of instruments used for checking the vibrations.</p>	<p>Machines. Practice on leveling – use of spirit level, camel back, straight edge, bridge, parallel block. Leveling of surface plates. Marking table. Milling machine. Lathe machine – preparation of test report indicating degree of flatness. Use of leveling bolts. Taper wedges for leveling of the horizontal and vertical surfaces. Preparing of foundation & anchor bolts.</p>
4.	<p>Different type of appliances and tackles for shifting, loading and unloading of machines and equipments. Screw jack – their use and working principles. Chain pulley block – their use and working principles. Concept of lifting, crane and hoist – working principles and main constructional features. Working principles and use of other tackles like crabs, winches, slings (wire rope & elastic), roller and bars, levers, lashing and packing. Importance of testing lifting tackles. Use of inclined plain. Special precaution in handling heavy equipments, removal and replacement of heavy parts. Safety in transportation.</p>	<p>Use of different type of lifting tackle both mechanical and hydraulics – such as screw jacks, chain pulley block, crabs and winches, rollers, bars and levers. Use of inclined plane. Hydraulic trolleys. Maintenance of lifting equipments. Method of lifting jobs of various shape, size and weight. Use of appropriate length of chains, Inspection of chain links and lifting tackles. Practice on the shop floor.</p>
5.	<p>Properties and use of ferrous and non-ferrous metals and their alloys, study of physical and mechanical properties of materials</p>	<p>Practical for testing mechanical properties like hardness, tensile strength, compressive strength, basic Heat Treatment process</p>

	<p>and testing of materials. Plastic deformation of materials. Micro structure of materials and Heat Treatment of ferrous metals.</p>	<p>for changing mechanical properties and its applications. Practice on exercises involving making of Simple Machine parts which have certain functional relationship to other parts such as driving mechanism, dovetail, assembling parts using bolts, dowel pin, locking devices. Precession fittings - involving sliding, scraping and alignment.</p>
6.	<p>Constructional features, working principles and uses of pumps. Positive and non-positive displacement of pumps, centrifugal pumps, gear pump, vane pump, piston pump. Constructional features and working principles of valves, Types of valves – directional control, pressure control, flow control, non-return. Compensating features: pressure, temperature and flow. Actuators: types & constructional features and principles of hydraulic Actuator. Fluid power symbols. Hydraulic and pneumatic power source and circuits. Study of different hydraulic and pneumatic circuits. Study of hydraulic oil, air, coolant filtration system and hydraulic accessories. Types of hydraulic oils, preservation, analysis contaminations and minimization of contaminations. Performance testing of hydraulic pumps.</p>	<p>Application of different types of valves in Hydraulic and Pneumatics circuits. Demonstration and practice on machine tool application of the hydraulic drives for rotary, reciprocating, speed changing, clamping, unclamping and feed motions. Setting of various hydraulic elements for proper functioning. Repairs of hydraulic presses and various hydraulically operated equipment, fault finding by simulation. Setting of pneumatic circuit elements for proper functioning – adjusting, cushioning of the cylinders flow and pressure. Practice on simple hydraulic & pneumatic circuits.</p>
7.	<p>Machine Alignment – different types – procedure, Equipment for aligning machines – use of test mandrel, master cylinder, straight edge, centricators, slip gauges and dial indicators. Precaution to be observed in the use of equipments while aligning.</p>	<p>Demonstration and practice of various spindle drive mechanism used on pedestal grinder, drilling, milling, shaper, lathe and grinding machines. Checking for spindle run-out, axial and radial play. Setting of play as per standard chart.</p>

	<p>Special precautions necessary for erection, leveling and aligning precision machines.</p> <p>Testing for correct functioning of machine parts and commissioning of machine.</p> <p>Geometrical testing of machine tools.</p>	<p>Checking of bearing performance – repairs and replacement as needed.</p> <p>Demonstration and practice of Shafts, Axles, Couplings and Clutches used on various machines.</p>
8.	<p>Classification of materials as conductors and insulators.</p> <p>Electrical Safety rules and precautions.</p> <p>Introduction to electrical supply system with special reference to AC. Different Voltages in use – AC and DC. Types of Main switches, circuit breaks, fuses, effects of electric current in general.</p> <p>Semiconductor Theory: Intrinsic & extrinsic semiconductors.</p> <p>P & N type semiconductors and P-N Junction – a semiconductor Diode.</p> <p>Use of P-N junction for rectification .Half wave .full wave and bridge rectifiers.</p> <p>P-N-P and N-P-N Junction devices-a transistor –three layer three terminal device. Use a transistor as a switch & its simple applications. Use of transistor for amplification – small signal amplifiers Logic gates: AND, OR, INVERTER, NAND, NOR, EX-OR etc.-</p> <p>Truth table, analogy of logic gates, combination of series & parallel switches. Related application, block diagram, input devices, output devices, cpu. Memory – RAM, ROM, PROM, EPROM.</p>	<p>Familiarization with different types of plugs, sockets, switches, fuses and fuses holders, cut out their specification and applications.</p> <p>Testing of switches, push buttons, limit switches by using continuity testers for their operation.</p> <p>Hand tools use in electrical works and safety precaution.</p> <p>Testing of components like resistors, capacitors, diodes and transistors.</p> <p>Verification of Logic Gates.</p> <p>Measurement of voltage & current at different test points.</p> <p>Demonstration of PLC program using ladder diagram.</p>

	<p><u>Introduction to PLC</u> Necessary information and its principle. Different hardware required in PLC. PLC programming languages. Addressing schemes, Application of PLC in Automation Industry.</p>	
9.	<p>Terminology of different types of gears, worm & worm wheel and rack & pinion.</p> <p>Repairs of gear teeth by binding up and dovetail insert method. Method of fixing gear, wheels for various drives. General causes of the wear and tear of the toothed wheels and their remedies.</p>	<p>Study of various machines tools such as Lathe, Milling, Radial drilling, Grinding shaping, slotting machine with special attention to transmission mechanism. Study of machine accessories, their function in operation.</p>
10.	<p>Computer awareness: General terms used in computer. Elementary of DOS & Windows.</p> <p>Concept of AutoCAD. Elementary commands of AutoCAD. Details of different menu & plotting.</p>	<p>Demonstration & Practice on DOS & Windows.</p> <p>AutoCAD commands and using different menu of AutoCAD. Drafting of simple machine parts with the help of different menu. Practice on plotting.</p>
11.	<p>Introduction to CNC Machines. Difference between NC, CNC and SPM.</p> <p>Importance of CNC machines over other mass production processes. Constructional details and Working principles of CNC Machines – Machine beds – ball screw mechanism – servo drivers – feedback Mechanism. Concept of ATC & APC. Access designation. Introduction to G and M codes, CNC tooling and fixtures Simple manual part programming commands.</p>	<p>Demonstration of CNC machine. Practice on special constructional and operational features with reference to driving mechanism, machine tool design, centralised lubrication system. Familiarization with co-ordinate system, use of CNC codes and programming and simulation for simple test jobs. Introduction to CAM software.</p>
12.	<p>Different types of Maintenance work.</p> <p>Preventive maintenance – Advantages of preventive maintenance, Aim – Basic Activity, Planning, Schedule Basic</p>	<p>Mini Project on trouble shooting, fault finding and rectification of machine tools.</p>

	<p>Aspects.</p> <p>Periodical Inspection – Frequency- Schedule-Types of schedule, Checklist, Preparation of Checklist.</p> <p>Record Maintenance- Record Register, Form, Instruction, Chart for Abbreviation, History sheet, General Maintenance Register.</p> <p>Layout of Maintenance Section:- Fault Finding Method-</p>	
13.	Industrial Visit, Revision and final examination	

LIST OF TOOLS & EQUIPMENTS

FOR THE TRADE OF

MECHANIC MACHINE TOOL MAINTENANCE

(TT – II)

UNDER MODULAR PATTERN

FOR

CRAFTS INSTRUCTOR TRAINING SCHEME

FOR A BATCH OF

16 TRAINEES AND ONE TRAINER

LIST OF TOOLS & EQUIPMENT

For TT - II: Tools & Equipment List is same as TT - I in addition following items are also required.

TOOLS & INSTRUMENTS FOR MAINTENANCE SHOP

<i>Sl.No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>Master Bar 45 Degre , scraping Bar 600 mm. width of bar 75 mm., thickness 25 mm., all sides to an accuracy of 0.02 mm seasoned.</i>	1 No.
2.	<i>Gear pump</i>	1 No.
3.	<i>Vane pump fixed and variable delivery</i>	1 each
4.	<i>Hydro motor</i>	1 No.
5.	<i>Accumulator (gas)</i>	1 No.
6.	<i>Pneumatic tools (Portable nut spanner /Runner ,chisel ,grinder sander and hammer)</i>	1 each
7.	<i>Hydraulic, Pneumatic trainer with necessary aggregates for different machine circuit.</i>	1 each Trainer
8.	<i>Hydraulic valves (Relief, Sequence, Unloading, Pressure- reducing, Check, flow control , directional Control Valves etc).</i>	1 each
9.	<i>Transparent Hydraulic cylinder</i>	1 No.
10.	<i>Cut model of pneumatic valve</i>	1 No.
11.	<i>Flow detector (Magnetic crack detector)</i>	1 No.
12.	<i>Engg. Stethoscope</i>	1 No.
13.	<i>Tool picker collets type</i>	1 No.
14.	<i>Tool picker magnetic type</i>	1 No.
15.	<i>Granite surface plate 1600X1000 with stand and cover</i>	1 No.
16.	<i>Solenoid valve (DC Valve)</i>	2 Nos.
17.	<i>Pneumatic motor</i>	2 Nos.
18.	<i>Bearing and gear tester</i>	1 each.
19.	<i>Pneumatic scraper with adjustable</i>	2 Nos.

	<i>stroke</i>	
20.	<i>Torch (3Cells)</i>	<i>2 Nos.</i>
21.	<i>Sledge Hammer 5 kgs.</i>	<i>1 No.</i>

MACHINIST TOOLS

<i>Sl.No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>Straight edge(steel) 1000 mm.</i>	<i>1 No.</i>
2.	<i>Spirit level 2 V 250.05</i>	<i>1 No.</i>
3.	<i>Spanner D.E. G.P. Series 2</i>	<i>2 Sets</i>

GENERAL MACHINE

<i>Sl.No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>Tensile and brinell hardness testing machine</i>	<i>1 No.</i>
2.	<i>C.N.C Trainer</i>	<i>1 No.</i>

FOR HEAT TREATMENT

<i>Sl.No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>Blacksmith's Anvil ,100 kg.</i>	<i>1 No.</i>
2.	<i>Smiths tongs hollow bit ,smiths Tongs flat (30 mm)</i>	<i>1 Each</i>
3.	<i>Water tank (450X300X250 mm).</i>	<i>1 No.</i>
4.	<i>Brass Rule 300 mm.</i>	<i>1 No.</i>
5.	<i>Furnace for Heat treatment</i>	<i>1 No.</i>
6.	<i>Oil Bath (for quenching) 45X45X45 cm.X6 mm thick plate</i>	<i>1 No.</i>

HOISTING EQUIPMENTS:

<i>Sl.No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>Fork lift max. capacity 1 Ton</i>	<i>1 No.</i>
2.	<i>Manila ropes 12,20,30 mm dia.(5 mtr. Length)</i>	<i>1 Each</i>
3.	<i>Crow Bar</i>	<i>4 Nos.</i>
4.	<i>Rollers (steel tubes) from 40 to 60 mm dia.(500 mm length) by 10 mm</i>	<i>5 Nos each.</i>
5.	<i>Block of Timber (various sizes)</i>	<i>10 Nos.</i>

6.	Portable jack	1 No.
7.	Cargo Winches 3, 5 Tonnes.	1 each.
8.	Wall Hoist	1 No.
9.	Shear Legs (tripod)	1 No.
10.	Hand Operated Chain Pulley block.	1 No.
11.	Conveyor	1 No.
12.	Ratchet chain Pulley block	1 No.

ERECTION TOOLS & EQUIPMENT

Sl.No.	Name of tools & Equipments	IS :Code No.	quantity
1.	Foundation Bolt (different Types)		4 Nos each.

ELECTRICAL TECHNOLOGY & ELECTRONICS

Sl.No.	Name of tools & Equipments	IS :Code No.	quantity
1.	Screw Driver (electrician) 150 mm with Tester detachable (and two No Flate two star head).		04 Nos.
2.	Screw Driver Philips Nos.860,861,862		02 Sets
3.	Long Nose Pliers 150 mm Insulated		04 Nos.
4.	Combination pliers 150 mm		04 Nos.
5.	Diagonal Cutter 150 mm		04 Nos.
6.	Tweezers		04 Nos.
7.	Knife 100 mm		04 Nos.
8.	Neon Tester A/C 230V		04 Nos.
9.	Scissors 150 mm		02 Nos.
10.	Soldering Iron 25 W (Saldron)		02 Nos.
11.	Soldering Iron 65 W		02 Nos.
12.	Digital Multi meter (Rish/multi)		02 Nos.
13.	Ammeter 0 to 500 ma = (10 amps) A/C		01 Nos.
14.	Ammeter 0-1a DC (0-5 amp)		01 Nos.
15.	Voltmeter 0-300-600 V AC		01 Nos.

16.	Discrete component Trainer		1 No.
17.	P.F.Meter		1 No.
18.	Frequency meter		1 No.
19.	Merger 500 V Magger		1 No.
20.	A.C. Squirrel Cage induction motor 3 with D.O.L. Start		1 No.
21.	Star Delta 3 starter		1 No.
22.	C.T. Single Phase		2 Nos.
23.	P.T. Single Phase		2 Nos.
24.	Auto Transformer 0-300 V 8 Amp		2 Nos.
25.	C.R.O. 50 MHZ		1 No.
26.	Digital I.C. Tester		1 No.
27.	Digital I.C. Trainer Kit		1 No.
28.	Audio single Generator with Sine wave, Square wave and Trangular wave.		1 No.
29.	DUAL D.C. Power supply 0-30 V, 2 Amp and 0-5V, 5 Am, \pm 15V, 2 Amp with indicator.		2 Nos.
30.	Demonstration model for Thyristorised D.C. Motor Drive (1 H.P.) Se up		1 No.
31.	Demonstration model for Thyristorised A.C. Motor drive (1 H.P.) Set up		1 No.
32.	Linear I.C. Trainer Kit		1 No.
33.	Digital Millimeter 2.5 Amps/5 (Rishmulti) Amps		2 Nos.
34.	Transducer		2 Nos.
35.	Thermocouples Kit		2 Nos.
36.	L.D.R.S Kit		2 Nos.
37.	Thermostat Kit		2 Nos.
38.	L.V.D.T Kit		2 Nos.
39.	Strain gauge		2 Nos.
40.	Photo Diode (component)		2 Nos.
41.	Photo Transistor Kit		2 Nos.
42.	A.C Timer Kit		2 Nos.
43.	D.C. Timer Kit		2 Nos.
44.	Decimal count Kit		2 Nos.
45.	D.C. Motor control Kit		2 Nos.
46.	Hand Tachometer		1 No.

47.	<i>Ammeter portable type 0-15 Amps. A.C</i>		1 No.
48.	<i>Insulated Screw Driver 200 mm.</i>		4 Nos.
49.	<i>Insulated combination side cutting pliers 200 mm.</i>		4 Nos.
50.	<i>Tang Tester (0-15 amps)</i>		1 No.
51.	<i>Cutter cum stripper</i>		4 Nos.

Computer Software & Trainer Kit:

<i>Sl. No.</i>	<i>Name of tools & Equipments</i>	<i>quantity</i>
1.	<i>AutoCAD latest version</i>	1 Set.
2.	<i>PLC Software latest version</i>	1 Set.
3.	<i>PLC Trainer Kit</i>	1 Set.