

MECHANIC CLOCK AND WATCH



CRAFTSMAN TRAINING SCHEME

AS APPROVED BY

GOVERNMENT OF GUJARAT

IN CONSULTATION WITH

**THE STATE COUNCIL FOR
VOCATIONAL TRAINING**

ISSUED BY :

**GOVERNMENT OF GUJARAT
MINISTRY OF LABOUR
DIRECTORATE GENERAL
EMPLOYMENT & TRAINING
GANDHINAGAR
GUJARAT**

1998

GENERAL INFORMATION

1. **Name of the Trade** : Mechanic Clock & Watch
2. **Entry Qualification** : Pass in 10th Class Examination under 10 + 2 system of education or its equivalent
3. **Duration of Craftsman** : 1 year

CRAFTSMAN TRAINING SCHEME

Trade : **Mechanic Clock & Watch**
Period : **1 Year**

COURSE CURRICULUM

Week No.	Practical	Week No.	Theoretical
1.	Introduction to Industrial Training Institute advantage of Trade and then given different Training.	1.	Industrial Training developed in our Country. Safety and its advantage First Aids
2.	Advantage of cleaning and Safety in Trade	2.	Workshop and its place Watch repairing tools and machinery.
3.	Uses of Watch repairing tools and its repairing (Tweezers, oil Pin, Wristwatch, screw-driver, player, etc.)	3.	Magnetizer, Waterproof, Test, Instrument, Watch, Cleaning Machine, Quartz, Tester etc.
4.	Write the name of parts Eight days running of without striking wall clock and Introduction with method of clock when its opening.	4.	Theory of time measurement, Earth's rotation, side reel day and solar day mean solar day, taxitudes and National.
5.	Eight days running of without striking wall clock servicing and with oiling running watch.	5.	Eight days running striking wall clock and how is cleaning step by wall clock.
6.	Hole punching and pivot policing and then Bush Fitting.	6.	Clock cleaning and oiling material pendilum Compensation (Pendulum)
7.	Introduction of parts Eight days running with striking wall clock opening and safety fitting of clock.	7.	Pivot Policy and Bushing To broken Pivot wheel and then repairing.
8.	Eight days running of striking setting and striking wall clock.	8.	Eight days running for scientific striking wall clock.
9.	Eight days running with striking wall clock of striking and oiling.	9.	Eight days running for Shikosha Japan striking wall clock.
10.	Making of clock main spring eye and hook.	10.	Main Spring repairing
11.	Clock bit adjustment Striking clock complete repairing and with oiling running watch	11.	Clock bit adjustment To broken wheel teeth and then repair

Week No.	Practical	Week No.	Theoretical
12.	Striking clock repairing and with oiling running watch	12.	Improved mechanical clocks, non—striking, striking, chiming and long case (Grand Father) clocks.
13.	Introduction of parts in Alarm Time piece Pivot policing Hole punching practice Alarm complete servicing and with oil running watch.	13.	Alarm Table Time piece Alarm clock setting
14.	Balance staff policing practice Replacement of New Balance Staff	14.	Changing the broken balance staff in alarm clock.
15.	Replacement of New Hair spring and time setting Hair spring repairing practice	15.	Alarm Bit adjustment Measurement of timing alarm clock
16.	Alarm timepiece complete servicing, oiling and complete fitting and time setting	16.	Lever pin setting and fitting of alarm clock
17.	Introduction of parts with method in wristwatch Cash-dial-key Balance cock-complete balance Gear Train, Breeze Barrel – Barrel Breeze Cannon – minute wheel hour wheel Winding Section	17.	Introduction to mechanical wrist watches. Mechanism of simple watch plate bridge main spring and barrel transmission, escapement balance & hair spring, winding and hand setting, dial train indicating system & casing. Types of case – dial and hands.
18.	Wrist watch opening and complete fitting train section Winding Section	18.	Wrist watch train section and Wrist watch section Winding Section
19.	Wrist watch complete servicing and oiling running watch	19.	Wristwatch Balance.
20.	Wrist watch complete servicing and with oiling running watch	20.	Wristwatch servicing and oiling materials.
21.	Day-Date wristwatch complete servicing and with oiling running watch	21.	Pin liver escapement and Jewel liver escapement
22.	New Balance plate, balance shaft, roller -fitting hairspring. Complete watch to balance fitting and time setting.	22.	Wristwatch Balance Shaft Fitting and balance wheel policing. Centre wheel and Cannon Pinion.
23.	Disassembly and assembly of quartz clock	23.	Testing and advantage of self-winding watch.

Week No.	Practical	Week No.	Theoretical
24.	Disassembly and assembly of quartz clock	24.	Dials – types, method of applying luminous compound.
25.	Disassembly and assembly of quartz clock	25.	Hands, types, methods of friction in fitting and removing including calendar and alarm watches.
26.	Disassembly and assembling quartz analog clock and testing at parameters and repairs use of multimeters.	26.	Cases, types, case openers.
27.	Disassembly and Assembling Quartz Alarm Clocks & Time Pieces	27.	Crystals, types of fixing.
28.	Disassembly and Assembling Quartz Alarm Clocks & Time Pieces	28.	Crowns, packing and gaskets, water resistant cases method of testing for water resistance. Apparatus used.
29.	Disassembly and Assembling Quartz Alarm Clocks & Time Pieces	29.	Assembly of movement in watch cases overall inspection at standards for crown back cover and appearance.
30.	Testing of watchcases for water resistance, antimagnetic and shock resistant tests. Quartz Watch	30.	Trouble shooting and repairs
31.	Disassembly, assembly and servicing of chronograph & stopwatch. Analog Quartz Watch	31.	Trouble shooting and repairs
32.	Disassembly, assembly and servicing of chronograph & stopwatch. Analog Quartz Watch	32.	Magnetic effects on watches, demagnetising a watch shock resistance tests, divers watches, chronograph watch mechanism.
33.	Calibre number of movements, size of movements (both in line and mms) methods of ordering new spare parts. Anadigi Quartz Watch	33.	Thermic coefficient, conditions under which thermic tests are to be carried out. Performance, testing of self-winding watches, apparatus used. Testing of watches, running tests, watch positions and method of checking total run down period. Nomenclature of watch parts.
34.	Repairing, servicing of hand wound watches, estimation of material & labour, repair & service charges.	34.	Hierological standards, ISO, ISI, NISH, DIN, AFNOR or BSS.

Week No.	Practical	Week No.	Theoretical
35.	Repairing, servicing of hand wound watches, estimation of material	35.	Hierological standards, ISO, ISI, NISH, DIN, AFN or BSS.
36.	Identification and method of connecting metres in circuits. Finding the value of Resistance by Voltmeter Ammeter method, colour code method, bridge method to prove Ohm's Law.	36.	Introduction to basic electricity matter, molecule, atom, and atomic structure. Definition of current. Voltage Resistance unit used. Types of Resistors, Ohm's Law.
37.	Measurement of power by voltmeter. Ammeter method by using wattmeter DC circuits series, parallel & combination & net circuits. Method of measuring a source of cell identification of power cell. Connection of power cell in series, parallel and combination study their effects. Method of knowing the leakage of power cell, creping method and handling power cells.	37.	Method of finding Resistance, power, energy and DC circuits. Primary and secondary cells power cells like mercury cell, silver oxide cell, rating of the cells, defects & handling instructions of cells. Method of connecting cells in series, parallel & combinations.
38.	Do experiments on magnetism, electromagnetism. To know the relation between current & magnetic fields in straight conductor & coil, find out its characteristics. Experiments on producing electricity with the help of magnets.	38.	Introduction to magnetism, classification of magnets definition, terms used in magnetism & their units. Properties of magnetic lines forces, electro magnetism, magnetic field around straight conductor carrying current relation between direction of current and magnetic field in a straight conductor. The relation between the direction of current & magnetic field in a coil.
39.	Do experiments on magnetism, electromagnetism. To know the relation between current & magnetic fields in straight conductor & coil, find out its characteristics. Experiments on producing electricity with the help of magnets.	39.	Relation between electromagnetic field and permanent magnetic field by a straight conductor carrying current placed in the field of permanent magnetic field. Relation between 'do' in loop placed in the field of permanent magnetic field. Faraday's law of electromagnetic field magnetic substance.

Week No.	Practical	Week No.	Theoretical
40	Identification of components like capacitors inductor, resistor and measure the value by using independence bridge. Connecting capacitors, inductors in series and parallel and series. Resonance circuit (LCR circuits). Do experiment on self-inductance and mutual inductance. Operate and study moving coil instruments as a voltmeter and ammeter. Use of multimeters and oscilloscope.	40	Introduction to AC terms and in AC generation of AC (AC generator) inductance definition of inductance, self-inductance mutual inductance units used. Factors governing the inductance of an inductor. Definition of capacitance unit used. Factors, governing the capacitors, AC circuits. Permanent magnet moving coil instrument purpose principle, construction and as a voltmeter. Application of multimeter & oscilloscopes.
41.	Identification of transistors. Finding characteristics of transistors, transistor as rectifier, amplifier and oscillator.	41.	Introduction to basic electronics, concept of semi-conductor N type and P type doping, & current conductivity, types of bias volt-ampere characteristics semi-conductor diode, rectifier circuits.
42.	Application of field effect transistor, thyristor, LCD. Introduction to digital electronic. Conversion of Decimal to Binary & Binary to Decimals. Application of addition, multiplication, division, resistors, shift resistors, OR, AND gate not gate, NAND gate Flip-flop counters logic gates like digital to analog to digital.	42.	Semi-Conductor PNP, NPN transistors field effect transistors, FET as an Amplifier circuit thyristor. Uni-junction transistor (UJT) LC oscillator, crystals and crystal oscillator. Tunnel diodes, zener diode, photoconductive diode, light emitting diodes, construction, driving, display of the numerical displays, liquid crystal display (LCD), seven-segment fluorescent display. Introduction to digital electronics. Binary numbers how each play is used for different counter, converting binary to decimal, converting decimal to binary. Shifting of decimal on binary points, basic logic gates AND gates OR gates NOR gates using of AND gates diode circuit for AND gates NAND gates NOR gates, flip-flop types of flip-flop clocked R-s. Flip-flops counters. What is I.C. Transistor, transistor

Week No.	Practical	Week No.	Theoretical
			logics (T.T.L.) logics (L.S. ICs C/MOS, ICs, shift resistors testing of parameters. (Complementary metal oxide semi conductor) ICs timer.
43.	Repairing and servicing of hand used wound watches – repairing and servicing of self-winding calendar watches.	43.	Principle of working of electronic clocks, watches, digital analogy – difference between mechanical and electrical working principles and accuracy.
44.	Repairing and servicing of Digital Clocks.	44.	Present day watches – various types of watches that are available today multifunctional watches stop watches.
45.	Repairing & servicing and testing chronograph stop watches & other types of watches	45.	Concerned related instruction of: 1. Balance type of electronic watch. 2. Tuning fork type electronic watch. 3. Quartz crystal type electronic watch. 4. Analog type crystal watch. 5. Function of step motor. 6. Digital type quartz crystal watch.
46.	Repairing & servicing and testing chronograph, stopwatches & other types of watches. Testing parameters, use of Nykrun - Wrwea	46.	General description of a watch circuit, analogue and digital – block diagram quartz, crystal, oscillating nature of quartz crystals. Function and application to watches, relationship between high frequency & accuracy.
47.	Disassembly, service & assembly of transistors and AC wall clocks & testing of discreet components.	47	Defects Diagnosis chart for clock, alarm clock
48.	Disassembly and assembly of quartz clock, analogue clocks including alarm clock.	48.	Defects Diagnosis chart for watch
49.	Testing parameters and rectification.	49.	Calculator, TV watches, game watches, dot-matrix watches, radio watch, body heat watches etc., Combinational watches such as digital-analogue and analogue & analog-digital setting methods for

Week No.	Practical	Week No.	Theoretical
			some of the present day watches. Concept of servicing between repair and customer.
50.	Disassembly and assembly of quartz digital testing of parameters troubleshooting and repairs of digital watches in a digital watch – use of oscilloscope and multimeter. Disassembly and assembly of combination watches like: -	50.	Calculator, TV watches, game-watches, dot-matrix watches, radio watch, body heat watches etc. Combination watches, such as digital-analogue and analogue-digital setting methods for some of the present-day watches – concept of servicing between repairer and customer.
51.	Exercises on Estimation, Industrial visit	51.	Industrial visit. Estimation of materials, cost, servicing, repairing charges. Revision.
52.	Revision	52.	Revision

**LIST OF TOOLS AND EQUIPMENT FOR THE TRADE OF
“MECHANIC CLOCK & WATCH”**

FOR THE BATCH OF UNIT OF 16 TRAINEES

Sl. No.	Items	For Trainees	For Instructors
1.	Dust Blower (Rubber)	16	1
2.	Tweezers – Watch Work	16	1
3.	Tweezers – Clock Work	16	1
4.	Tweezers – Hair Spring Work Straight	16	1
5.	Tweezers – Brass	16	1
6.	Tweezers – Plastic	16	1
7.	Tweezers – (for Electronic Watch Work)	16	1
8.	Tweezers – Hair Spring Work Bent	16	1
9.	Watch Makers Screw Driver Set of Ten (1 to 10)	16	1
10.	Pliers for Hand Remover Loosner	16	1
11.	Pliers for Cannon Pinion Loosner	16	1
12.	Pliers for Crown	16	1
13.	Pliers for Hand Cutting	16	1
14.	Pliers for Cannon Pinion Removing	16	1
15.	Pliers for Collet Removing	16	1
16.	Pliers for Roller Removing	16	1
17.	Pliers for Holding Pallet Fork (Levers)	16	1
18.	Pliers for Stud Pin Cutting	16	1
19.	Pliers for Guard Pin	16	1
20.	Pliers for Balance Truing	16	1
21.	Pliers Square Nose 100 mm.	16	1
22.	Pliers Taper Nose 100 mm.	16	1
23.	Nipper Watch Maker’s (Top Cutter) 100 mm	16	1
24.	Nipper Watch Maker’s with Handle	16	1
25.	Pin Vice Precision Double ended with Reversible Chucks	16	1
26.	Tool with Prong End for Bending Lever	16	1
27.	Bell Jar Glass	16	1
28.	Needle File (Swiss Set of 12 Needle File)	16	1
29.	Box Aluminum with Glass Top Set of 2 Nos.	16	1
30.	Movement Holder Universal Set of 3 Nos.	16	1
31.	Benzene Cup	16	1
32.	Sliconiosed Cloth	16	1
33.	Dial Cleaning Brushes	16	1
34.	Escapement Tring Tool A.B.	16	1
35.	Roller Grinder for Screwdriver	16	1
36.	Collet Turning Tool	16	1

37.	Acrylic Punch	16	1
38.	Snap type Back Cover Openers	16	1
39.	Torque Screwdriver (only for HMT Watches)	16	1
40.	Oil Cup Three Nos. for Each (A set of 3 nos.)	16	1
41.	Oil Pin with Handle	16	1
42.	Deer Skin Sheet	16	1
43.	Handle Pusher (To fix the hands)	16	1
44.	Eyeglasses (to fix the hands)	16	1
MEASURING INSTRUMENTS & GENERAL SHOP OUTFIT			
1.	Riveting Sticks	8	
2.	Punch Box with 120 Punches	2	
3.	Hammer, Ball Pain 100 gm. with Handle	2	
4.	Tool Poising for Balance	2	
5.	Telescopic Gauges	1	
6.	Oiler Clocks (Syringe Type)	1	
7.	Plier with Main Spring with Five Punches	1	
8.	Tool for Opening Lever Notch	2	
9.	Block Wheel Stretching	1	
10.	Block Riveting	2	
11.	Time Piece of Different Makes (8 Sets) 2 each	16	
12.	Watch Wrist (Gents) Different Makes (4 Sets)		
	1. Hand Wound	8	
	2. Automatic Day & Date	8	
	3. Hand Wound with Calendar	8	
13.	Ladies Watch	4	
14.	Clock Wall Type Pendulum, Non-Pendulum Striking of Different Makes	10	
15.	Electric / Electronic Watches and Clocks	4	
16.	Transistorized Pendulum Clocks	2	
17.	AC Clocks	2	
18.	Quartz Analog Clocks (Musical with Striking, Day and Date and Pendulum Type)	8	
19.	Quartz Analog Wrist Watch with Day Date of Different Makes Watch	8	
20.	Echnos With & Without Calendar Mechanism Of Different Makes	8	
21.	Quartz Digital (LCD) Wrist Watch Multi-function (C) Type of Different Makes	8	
22.	Quartz Digital (LCD) Wrist Watch Basic function of Different Makes	4	
23.	Quartz Digital (LCD) Wrist Watch Alarm Type Of Different Makes	4	
24.	Quartz Digital (LCD) Wrist Watch Combination Watch Type of Different Makes	4	

25.	Stop Watches	4	
26.	Stop Clocks	4	
27.	Vice Bench Swiveled Base 50 mm Jaw	4	
28.	File Hand Second Cut 100 mm Flat	4	
29.	File Hand Smooth Cut 100 mm Flat	4	
30.	File Hand Round Second Cut 100 mm Flat	4	
31.	Soldering Iron Electric for Watch Maker AC 220 Volt, 20 Watts	2	
32.	Fire Extinguisher	1	
33.	Fire Buckets with Stand	2	
34.	Chair Adjustable for Height of Seat and Back	17	
35.	Steel Locker with 8 Drawer	2	
36.	Desk Bench Working 1800 x 900 x 5 mm	1	
37.	Stool	1	
38.	Black Multi-Tester	2	
39.	Main Spring Winder	4	
40.	Truing Caliper	4	
41.	Sprit Lamps	4	
42.	Crystal Fixing Jig with 20 Dies	2	
43.	Micro Tip Soldering Irons 10 Watts	2	
GENERAL INSTALLATIONS			
1.	Table Working (95 x 100 Height x 45 Cams.) with Drawer and Glass Framing on Three Sides also Fitted with Tube & Shade	16	
2.	Cleaning Machines Ultrasonic	1	
3.	Cleaning Machines Electric	2	
4.	Profile Projector	1	
5.	Time Testing Machine (Recording Type Micro Mat / Vibrograph or equivalent)	2	
6.	Quartz Tester	2	
7.	Multipurpose Case Opener	2	
8.	De-Magnetizer	2	
9.	Water Resistance Testing Apparatus (Bubbles Testers)	2	
10.	Stereoscopic Microscope 15 x 30	2	
11.	Ampere meter or Grad scope	1	
12.	Antimagnetic Tester	1	
13.	Jig for Fitting Flat Crystal	1	
14.	Multi-Quartz Module Tester for Measuring Voltage Resistance of Electronic Watch	2	
15.	Voltage Stabilizer 2.5 KVA	2	
16.	Air Conditioner 2.5 Ton with Voltage Stabilizer (1 No. 10 Sq. Mts.)	2	

17.	Temperature Controlled Soldering Iron 0.3 Watts with Dive Tips from 2 mm to 8 mm	2	
18.	Compact Musical CD System With 10 Musical Audio CD	1	
19.	White Apron for Students	16	
20.	White Caps for Student and Visitors	20	
21.	Hawaii Slipper for Students / Visitors	20	
22.	Time Rate Test Equipments for Quartz Watches	2	
23.	Auto winding Tester	1	
24.	Buffing Machine	1	
25.	Case Leak Checking Apparatus Hand Operated or Foot Operated	1	
26.	Vacuum Cleaner Machine	1	

LIST OF REFERENCE HOROLOGICAL BOOKS

Sl. No.	List of Books	Rate per Copy (Approx.)
1.	Gears for Small Mechanism – W.O. Davis	561.00
2.	Practical Clock Repairing – Donald DE Carle	63.20
3.	Practical Watch Repairing – Donald DE Carle	63.20
4.	Electrical Time-Keeping – Frank Hope Jones	72.00
5.	Watch & Clock Making and Repairing – Gazeley	96.00
6.	Watch and Clock Encyclopedia – Donald DE Carle	63.20
7.	Watch Repairers Manual – HB Fried	96.50
8.	Electronic Clocks & Watches – Michael S. Robbins	61.10
9.	Bench Practices for Watch and Clock Makers – HB Fried	101.05
10.	Clocks and Watches – Johan Niassberger	329.00
11.	The Swiss Watch Repairers Manual – H. Jen-Dritzki	205.00
12.	Complicated Watches & Their Repair – D.D. Carle	67.23
13.	Electronics Time Measurement – Chamle Mulsizel MAC Nichol Nilways	40.95
14.	Watch Adjustment – Jendritzki H.	205.00
15.	Advanced Watch and Clock Repairs – H.G. Harris	01.14
16.	Modern Watch and Clock Repairs – H.G. Harris	72.34
17.	Clock and Watch Escapement – Gazdy	79.74
18.	Build-in Book of Digital Elec. Time Pieces – Robert Haviland	54.43
19.	Understanding Electronic Time-Keeping – ICM Hyltin	35.60
20.	Repairing, Quartz LED-LCD and Analog Watches - Scriptar SA.	244.15
21.	Clock Material Manual – HS Walsh & Sons Ltd.	41.63
22.	Clock Cleaning & Repairing – Bernard E. Jones	30.00
23.	The Watch Makers Lathe & How to Use It – Donald De Carle	75.00
24.	The Watch Escapement – HB Fried	90.00
25.	The Brithens Watch & Clock Makers Handbook Dictionary and Guide – TC Briteen	704.00
26.	Digital Electronics – Rigers – L. Tokhum MacGraw Hill	-
27.	Lessons from British Horological Institute, London Vol. I, Vol. II, Vol. III, with Twelve Lessons in each set	-
28.	Dictionary Horology	-
29.	Passport to Electronic Watches	-