

**SYLLABUS FOR THE TRADE
OF**

**MECHANIC LENS/PRISM GRINDING
(SEMESTER PATTERN)**

**UNDER
CRAFTSMEN TRAINING SCHEME (CTS)**

Designed in: 2013

By
Government of India
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
Directorate General of Employment & Training
Ministry of Labour & Employment
EN-Block, Sector-V, Salt Lake
Kolkata-700 091

List of members of Trade Committee meeting for the trade of
“Mechanic Lens/Prism Grinding” held at ATI, Chennai

SL. NO.	NAME & DESIGNATION	REPRESENTING ORGANISATION	REMARK
1	Shri. A.Mahendiran	ATI,Chennai	Chairman
2	Shri.S.Harinath Babu, Joint Director of Training	ATI,Chennai	Member
3	Shri.M.Thamizharasan,Dy.Director of Training	ATI,Chennai	Member
4	Shri.K.Srinivasa Rao, Dy.Director of Training	ATI,Chennai	Member
5	Shri.Mustaq Ahmed	Grace & Noble, Consultancy Chennai-3	Member
6	Shri.K.V.Rao,Asst.Director	MSME-Development Institute, Chennai-32	Member
7	Shri.Vyshakh	Govt. ITI, Mala, Kerala	Member
8	Shri. Bimal	Govt. ITI, Mala, Kerala	Member
9	Smt.N.Anantha Lakshmi	Essilovi India Pvt. Ltd, Chennai	Member
10	Shri.Prem Sudhakar	Lawrence & Mayo Ltd Chennai	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. Muhkerjee, 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 : Mechanic Lens/Prism Grinding.
2. N.C.O. Code No. :
3. Duration : One year
4. Power norms : 7.5 KW
5. Space norms : Workshop: 100 Sqr meter.
6. Entry Qualification : Passed 10th class examination under 10+2 system of education with Science and Mathematics or its equivalent.
7. Unit size (No. of Student) : 12
8. Instructor's/ Trainer's Qualification : (A) Degree in Mechanical Engineering from recognized engg. college/university with one year experience in the relevant field.
OR
Diploma in Mechanical Engg from recognized board of technical education with two years experience in the relevant field
OR
10th/Madhyamic pass + NTC/NAC in the relevant Trade with 3 years post qualification experience in the relevant field.

(B) Desirable qualification :
Preference will be given to a candidate with Craft Instructor's Certificate.

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

Syllabus for the Trade of “**MECHANIC LENS/PRISM GRINDING**” *under C.T.S.*

Duration: Six Month

First Semester

Code: MLG – Sem - I

Week No.	Trade practical	Trade Theory	Engg.Drawing	Workshop calculation & science
1	-Familiarization with the Institute -Importance of Trade training --Different skills involved in the trade. -Observing safety precautions in the job & precision/critical aspects in the job.	-Importance of safety and general precautions observed in the Institute -Safety codes and standards applicable to glass and mirror workers -Care and handling of glasses -Safety appliance such as goggles, face mask hand gloves etc.	INTRODUCTION Important of Engineering drawing and its knowledge	INTRODUCTION Importants of science and calculation to the trade skill and fundamental arithmetical operations addition subtraction, multiplication and division
2	<u>BASIC FITTING GRINDING & BENCH WORKING:</u> -Identification of different hand tools related to the trade and handling Grinding of chisel	-Description of hand tools, uses, care maintenance. -Description of chisels and its application	-Use of Drawing Instruments. T-square Drawing Board etc	GENERAL SIMPLIFICATIONS -Fraction, Addition, Subtraction, Multiplication and Division problems
3	-Marking and sawing practice on M.S flats 6 mm thick	-Description of Hacksaw &Grinding Wheels,Diamond cutter and Trepanning Tools. Hacksaw frame, blade types and application	- Letters, Numbers and Alphabets as per IS 696-1972	- Fraction, Addition, Subtraction and Multiplication problems
4	-Filing practice, simple fitting works, marking practice with steel rule, dividers and callipers (circles, areas, parallel lines). Use of Vernier calipers and Micrometer and Depth gauge	-Files specification, description, uses , measuring standards (English, Metric units) Description of dividers, calipers, vernier calipers and Micrometer, Depth gauge uses and care & maintenance	-Letters, Numbers and Alphabets as per IS 696-1972	-Decimal - Addition, Subtraction, Multiplication, Division problems

5	-Drilling different sizes of holes by hand and Machine	-Familiarization of Drilling machine and uses -Drills types and operations	-Free hand sketching of straight lines, rectangles, circles and polygons	-Fraction and decimals conversion -Fraction to Decimal and vice versa
6	-Trepanning (format cutting)	-Different types of Trepanning Tools & Tool Holder.	-Use of different types of lines and symbols for drawing. Important of putting dimension on the drawing as per IS 696-1972	-Decimal - Addition, Subtraction, Multiplication, division – problems
7	-Use of screw drivers, spanners, pliers, etc. -Use of Electric heater for heating glasses. -Use of various types of Tongs	-Description of screw drivers, pliers and spanners. -Description of Tongs, size, types and uses. -Glass cutting tools – Description of Diamond tipped cutter and wheel type cutter.	-Free hand sketching with dimension scale and proportionate sketching	-Decimal - Addition, Subtraction, Multiplication and Division problems
8	<u>MAKING OF GLASS MIRRORS FROM SHEET GLASS</u> -Identification & Demonstration of materials of different Glasses such as soda lime glass, potash lime glass, potash led glass and common glass -Cleaning, Marking and cutting of glasses to different shapes such as square, rectangle, on 3 mm and 5.5 mm thick glasses	-Types of glasses and commercial forms of glasses and glass materials (sheet glass and plate glass) and their uses -Important of glasses in Engineering field -Glass materials and its composition 1. Idea about ‘refractive index’ & ‘V value’ 2. Types and major classification of glass such as soda lime glass, potash lime glass, potash led glass, common glass 3. Use of glass/optic in different fields.	-Reading of simple blue print	METALS: -Properties and uses of cast iron , wrought iron, plain carbon steel and alloy steels

9	-Cleaning, Marking and cutting of glasses to different shapes such as step cutting and circular cutting on 3 mm and 5.5 mm thick glasses	-Defects in Glass materials & detection of defects 1. Nature of defects (i.e. air bubbles, veins, in- homogeneity etc.) 2. Adverse effects on products for these defects. 3. Instruments/ Equipments used to detect these defects.	-Isometric views and oblique views with dimensions of such as Cube, Rectangular block, Cylinder etc.	-Properties and uses of cast iron, wrought iron, plain carbon steel and alloy steels
10	-Drilling on plain glasses 3mm, 5 mm and 10 mm thick	-Types of glasses such as coloured glass, bullet proof glass, fiber glass, foam glass, float glass, glass blocks, heat excluding glass, obscured glass, safety glass, shielding glass, ultra violet ray glass, wired -glass,	-Explanation of simple Orthographic projection - 1st angle projection as per IS 696 - 1972	-Properties and uses of Copper, Zinc, Lead, Tin and Alluminium
11	-Forming of glass for making concave mirror	Types of mirrors such as plain or straight mirror, spherical or curved mirror (concave and convex)	-Explanation of simple Orthographic projection - 3rd angle projection as per IS 696 - 1972	-Properties and uses of Brass, Bronze, Rubber and Timber
12	-Forming of glass for making convex mirror	-Glass moulding process.	-Sketching the views of solid bodies when viewed perpendicular to their surfaces and axes	UNITS: -Systems of units- British, metric and SI units for Length, Mass, Area, Volume, Capacity and Time
13	-Grinding of glasses to different profiles	-Glass mould components 1. Nick ring 2. Bottle mould 3. Bottle plate	-Sketching the views of solid bodies when viewed perpendicular to their surfaces and axes	-Conversion between British and Metric system

14	-Sensitizing of glasses	-Indian standard quality specification for silvered glass mirror for general purpose and furniture mirror	-Free hand sketching of plan and elevation of simple objects like Hexagonal bar, Circular bar, tapered bar and Hollow bar etc.	SQUARE ROOTS -The Square and Square roots of whole number and decimal, shop problems -Pythagoras theorem
15	-Polishing of glasses	-Surface preparation of glasses – polishing compounds and polishing procedure	-Reading of simple blue print	HEAT AND TEMPERATURE: -Definition of Heat and Temperature -Effect of Heat, Thermometric scales such as Celsius, Fahrenheit and Kelvin. Temperature measuring instruments
16	-Surface preparation and Silvering of Glass mirrors	-Silvering of glass mirrors	-Views of simple Hollow and solid Bodies with Dimensions	-Conversion between the above Scales of Temperature -Units of Heat-Calorie, B.Th.U.,C.H.U. Specific Heat, Latent Heat, Heat Loss and Heat Gain - simple problem
17	-Coppering of Glass mirrors	-Coppering of glass mirrors	-Views of simple Hollow and solid Bodies with Dimensions	PERCENTAG -Changing percentage in to Decimal and Fraction and vice versa- problem on percentage related trade
18	-Painting on glasses	-Types of paints used for painting glasses and painting procedure	-Construction of Orthographic	-Percentage-Changing percentage in to Decimal

			Projection from the given isometric view of shaped Blocks in First angle method	and Fraction and vice versa- problem on percentage related trade
19	-Inspection and testing of Glasses and Glass mirrors	-Inspection and testing of glasses and Glass mirrors	-Construction of Orthographic Projection from the given isometric view of shaped Blocks in First angle method	-SPEED AND VELOCITY: Definition, difference between speed ,velocity and acceleration. -MASS AND WEIGHT: Definition, difference between Mass and Weight
20	-Project work - manufacturing of furniture mirror	-Project work - manufacturing of furniture mirror	-Construction of Orthographic Projection from the given isometric view of shaped Blocks in 3 rd angle method	-Newton's Law of motion -Definition of Force, unit of force in MKS system and S.I Unit of Force
21	Project work - manufacturing of concave and convex mirror	Project work - manufacturing of concave and convex mirror	-Construction of Orthographic Projection from the given isometric view of shaped Blocks in 3 rd angle method	RATIOS AND PROPORTIONS: -Ratio-Simple problems in Ratios
22	-Project work - manufacturing of dentist mirror	-Project work - manufacturing of dentist mirror	-Construction of Orthographic Projection from the given isometric view of shaped Blocks in 3 rd angle method	-Proportions-direct and inverse -Proportions – shop problems

23	-Project work - manufacturing of periscope	-Project work - manufacturing of periscope	do	do
24	-Project work - manufacturing of periscope	-Project work - manufacturing of periscope		
25	Project work / Industrial visit (Optional)			
26	Examination.			

Syllabus for the Trade of “**MECHANIC LENS/PRISM GRINDING**” *under C.T.S.*

Duration : Six Month

Second Semester

Code : **MLG – Sem - II**

Week No.	Trade practical	Trade Theory	Engg. Drawing	Workshop calculation & science
1.	-Familiarization with the Institute Importance of Trade training Different skills involved in the trade. Observing safety precautions in the job & precision/critical aspects in the job.	Importance of safety and general precautions observed in the Institute Safety codes and standards applicable to glass and mirror workers Care and handling of glasses Safety appliance such as goggles, face mask hand gloves etc.	-Print reading related to missing lines and missing views -Exercise on blue print	WORK POWER ENERGY: -Units of work in M.K.S system and SI unit of work -Simple problems of Power
2.	Identification & Demonstration of materials of different Lenses	A) Optical materials and its composition 1. Types of lens (glass, CR 39, poly carbonate etc.) 2. Use of optical lens in different fields B) Defects in Optical lens materials & detection of defects Nature of defects (i.e. air bubbles, veins, In homogeneity etc.) 2. Adverse effects on products for these defects. 3. Instruments/Equipments used to detect these defects.	-Drawing simple Isometric views from Ortho graphic views -Drawing views of lenses and Prisms	Laws of reflection, refraction and dispersion

3.	<u>PARAMETERS OF LENSES</u> Determination of Radius of curvature & Focal length of different lenses and determination of power by different methods	Uses of lenses and prism Reflection, Refraction Refractive Index, and Dispersion	-Free hand sketching of spectacles	-Practical units of power such as Watt and Horse Power -Definition of I.H.P, BHP and Efficiency
4.	<u>MAKING OF LENSES, & PRISMS.</u> Practice on use of spherical block 60 mm dia. Lens setting on spherical block setting of lens	Concept & understanding of the lens maker's formula, different types of lenses focal length Vs radius of curvature, linear & angular magnification. Power of different lenses. Unit of Power (Dioptre).	-Free hand sketching of riveted joints -Exercise on Blue print reading related to missing dimensions and missing dimensions and missing sections	-Definition of Energy, Potential Energy and Kinetic Energy - Simple problems related to Potential Energy and Kinetic Energy
5.	Heating pitch, placing on block with power glass (Bio-Focal) , setting axis. Lens setting on cylindrical block Working process: (Trepanning)	Different terminology related to optical lens. Defects of Lenses/images Spherical aberrations, Chromatic aberrations, Astigmatism, Coma etc.	-Free hand sketching of Nuts and bolts with dimensions from samples -Free hand sketching of hand tools of the trade	-Laws of Conservation of Energy, S.I. Units of Energy - Problems related to Potential Energy and Kinetic Energy
6.	Shaping, Rubbing, finishing, and Polishing by Cerium oxide and White oxide.	Methods of overcome aberration. Different applications of Lenses. Concept of 'A spherical Lens' for corrections spherical aberration and idea of 'Extra Dispersion Lens (ED)' and Polarize Glass	-Free hand sketching of hand tools of the trade	ALGEBRA: -Algebraic symbols and Fundamentals, Addition, Subtraction, Multiplication and Division -Algebra – Simple equation problems
7.	Setting Cylindrical die (Tool) Operate cylindrical m/c. /spherical m/c.	Manufacture of optical components from material available in market 1. Material in the form of glass slab/glass mould	-Free hand sketching of hand tools of the trade	-Algebra- Simultaneous Equation Problems -Algebra - Quadratic Equation problems

		2. Machines used in manufacture of optics (i.e. slicing, Trepanning, Milling, Curve generating, Grinding, Smoothing Polishing, Centering & edging etc.		
8.	Practice on different operations involved in manufacturing of Lenses. 1 Curve generation. 2 Grinding 3 Smoothing 4 Polishing & Hand Polishing	Manufacture of optical components from material available in market (continued) 3. Tools & Cutters used for manufacture of Optics. 4. Abrasives and its grades used for grinding & polishing of optics. 5. Process for manufacture of lenses, prisms & other types of optical components.	-Free hand sketching of keys and cotters with their dimensions from samples as per IS standard	-Levers: Types of Levers with their examples
9.	Practice on different operations involved in manufacturing of Lenses. 5. Centering & Edging 6. Inspection of various parameters 7. Cementing of lenses 8. Fusion of Lenses 9. Anti reflection coatings	Description of Gala (Dammar) Types & uses in grinding of Lenses Method of Heating pitch for fixing agents Familiarization with cylindrical block	-Free hand sketching of screw threads with their dimensions from samples as per IS standard	-Simple problems on straight and ball cranked levers -DENSITY & SPECIFIC GRAVITY: -Mass, weight and Archimedes principles & related problems
10.	<u>SPECTACLES LENSES</u> 1. Selection of glass moulds 2. Polishing & Profiling to suit in frame 3. Measurement of power and axis	Method of finishing and polishing and use of cerium oxide and white oxide. Use of different abrasives of different grades	-Geometrical development of Prism, Pyramid and Isometrics	-MENSURATION: - Area square rectangle, Equilateral Triangle, Isosceles Triangle, Right angled Triangle, Scalene Triangle problems

11.	<u>SPECTACLES LENSES</u> 4. manufacturing of Bi-focal lenses 5. Transmission measurement	Description of dies (optical glass) Types of die, sizes and their uses Uses of cylindrical and spherical m/c	Exercise on blue print reading related to surface symbols	- Area square rectangle, Equilateral Triangle, Isosceles Triangle, Right angled Triangle, Scalene Triangle problems
12.	<u>Lens fitting:</u> Lens fitting on frame by grinding, edging and sizing according to the required frame. Mounting of lens in frame	Familiarization of edging machine and uses of different types of glass moulds in accordance with polishing and profiling	-Triangular prism and hexagonal prism- projection and development	-Areas- Hexagon, Circle, Circular ring, Sector and Ellipse - problems
13.	<u>Inspection & Quality Control</u> 1. Use of test plates /proof plates 2. Measurement of curvature & use of instruments (optical spherometer)	Defects of eye and correction using lenses. Different parameters of spectacles.	-Cylinder projection and development -Cone projection and development -Examples based on Right cones	- Areas of Prism, cone, cylinder, hallow cylinder-shop problems
14.	<u>Inspection & Quality Control</u> 3. Measurement of Focal Length for +Ve & -Ve Lenses & Mirrors 4. Use of optical measuring devices such as 'Angle Dekkor', Lensometer, Refractometer, Spherometer, Interferometer, Strain viewer etc. Idea about optical aberrations.	Methods of testing of parameters of spectacles.	-Cylinder projection and development -Cone projection and development -Examples based on Right cones	- Volume and Weight of simple solid bodies such as Cube, Square, Prism Rectangular Prism, and Hexagonal Prism
15	<u>Making Prism & other flat surfaces</u> Practice on different operations For manufacturing of prisms and other flat surfaces 1. Profiling 2. Blocking	Types of prism such as right angle prism, dispersing prism, penta prism, rhomboid prism and their applications	-Views of simple solid bodies cut by section plane on drawing methods (Full and Half Sections) I.S. 696/1972	-Volume and weight of simple solid bodies such as Cube, Square Prism, Rectangular Prism, Hexagonal Prism, Triangular Prism, Cone and Cylinder shaped Vessels

	3. Grinding 4. Smoothing 5. Polishing			
16	<u>Making Prism & other flat surfaces - continued</u> 1. Removal from block 2. Cleaning 3. Measurement of parameters 4. Anti-reflection coating 5. Cementing (if applicable)	Principle of manufacturing of prisms & other flat surfaces Parts of lens and prism	-Views of hollow bodies with dimensions	- Finding the capacity of in litres of Square, Rectangular, Hexagonal, Conical and Cylindrical shaped Vessels
17	<u>Surface finish on optical components</u> 1. Manufacture of front surface & back surface mirrors. 2. Chemical silvering on optics 3. Vacuum deposition of different materials on optics	Different applications of prism Blocking materials for prism making	-Exercise on Blue print reading -Sketching of finished articles from drawings preparation of sequence	Finding the lateral surface area and Total surface Area of Square, Rectangular, Hexagonal, Cone and Cylinder Shaped Vassals, Further practice of Mensuration problems
18	<u>Surface finish on optical components – continued</u> Anti-reflection coatings on optics Cementing of optical components	Basic Idea about special types of optical components 1. Graticules/Raticles 2. Cylindrical Lenses 3. Bi-Prism 4. Refraction Gratings	-Free hand sketching of simple objects related to the trade and preparation of simple working drawing from the sketches	PROPERTIES OF MATERIALS : -Elastic limit, Ultimate tensile strength, Toughness, Brittleness, Ductility, Malleability, Creep etc
19	Silvering of Lenses and Prisms	Application of silvered lenses and prism Silvering procedure	Drawing different types of Lenses with dimensions	Different types of optical material their properties and use
20	<u>Optical instruments & devices</u> Demonstration & practice on application of different optical instruments and devices	Tools and machines used in manufacturing of optical instruments	-Conventional representation of Materials by B.I.S	STRESS & STRAIN: -Definition of Stress, Strain, Modulus of elasticity and Factor of safety -Simple problems related to Stress & Strain

21	<u>Optical instruments & devices</u> Demonstration & practice on application of different optical instruments and devices 1. Telescope 2. Microscope 3. Binoculars 4. Periscope 5. Range Finder 6. Theodolites 7. Night Vision devices	Optical instruments & its basic functions 1. Telescope 2. Microscope 3. Binoculars 4. Periscope 5. Range Finder 6. Theodolites 7. Night Vision devices	-Method of indicating surface roughness by B.I.S	BASIC ELECTRICITY: -Electric current, Voltage, Power, resistance , conductors and insulators -Ohms law, Faraday's laws of Electromagnetic Induction, Types of current effects of Current and related problems
22	Use of Refraction equipments and its basic functions 1. Lensometer, 2. Auto Refractometer, 3. Slit lamp, 4. Lens tray, 5. Lens frame 6. optical refraction unit, 7. Phoropter 8. Retinoscope. Idea about optical aberrations	Refraction equipments and its basic functions 1. Lensometer, 2. Auto Refractometer, 3. Slit lamp, 4. Lens tray, 5. Lens frame 6. optical refraction unit, 7. Phoropter 8. Retinoscope.	-Method of indicating surface roughness by B.I.S	BASIC ELECTRICITY: -Electric current, Voltage, Power, resistance , conductors and insulators -Ohms law, Faraday's laws of Electromagnetic Induction, Types of current effects of Current and related problems
23	<u>Project work</u> 1. Making of spectacles Making of prism & magnifying glasses	<u>Project work</u> 1. Making of spectacles 2. Making of prism & magnifying lenses	do	do
24	<u>Project work</u> 1. Making of spectacles 2. Making of prism & magnifying glasses	<u>Project work</u> 1. Making of spectacles 2. Making of prism & magnifying lenses	do	do
25	Revision			
26	Examination			

MECHANIC LENS/PRISM GRINDING

List of tools & equipments for 12 trainees + one

A. Trainees Kit – (As per the below table)

Sl.No.	Name of the Items	Quantity
1,	Steel rule 150 mm (Graduated both English and metric)	13 Nos.
2.	Outside calipers	13 Nos.
3.	Inside Calipers	13 Nos.
4.	Odd leg caliper 150 mm	13 Nos.
5.	Scriber 150x3 mm	13 Nos.
6.	Combination Pliers 150 mm	13 Nos.
7.	Goggles (fiber plastic cup) safety glasses	13 Nos.
8.	Hammer ball pein ½ lb.	13 Nos.
9	Hand gloves leather	13 Nos.
10	Face mask	13 Nos.
11	Try square	13 Nos.

B. General Machinery Shop Outfit (as per the table)

Sl No.	Name & Description of the Tools	Quantity
1.	Hammer copper 0.50 kg	06 nos.
2.	Oil cane	06 nos.
3.	Drill Chuck 12 mm cap. Taper shanks	06 nos.
4.	Diamond wheel dressing (single stone mounted)	12 nos.
5.	Files, Hand flat 200 mm smooth	12 nos.
6.	Files 150 mm Half round	12 nos.
7.	Files- Triangular, Dead smooth 200 mm and 150 mm	06 nos.
8.	Hacksaw frame 200 to 300 mm adjustable	06 nos.
9.	Oil stone carborandum, coarse on one side and fine on the other 200x50x25 mm	12 nos.
10.	Screw Driver 200 mm	06 nos.
11.	Screw Driver 300 mm	06 nos.
12.	Spanner D.E. (both Metric & English)	03 sets each
13.	Fitter vice 4" Jaw (100 mm)-2 nos.	06 nos.
14.	Center punch 150x6 mm dia-2 nos.	06 nos.
15.	Chisel cold flat 12 mm –2 nos	02 nos.
18.	Hand drill 6 mm-capacity	2 nos
19.	Drill Twist 1 mm to 12 mm, in step of 1 mm	2 nos.
20.	Set of Morse sockets (0-1), (1-2) and (2-3)	1 no
21.	Fire Extinguisher	2 nos.
22.	Fire Buckets with stand	2 nos.
23.	Adjustable wrench 250 mm size	4 nos.
24.	Grease Gun	1 no
25	Vernier caliper 200 mm, inside and outside (graduated in inches and millimeters) least count 0.020 mm as per IS 3651	6 nos.
26	Wooden foldable scale metric	12 nos.
27	Universal bevel protractor – blade range 150 and 300 mm, dial 1 degree, Vernier 5' with head, acute angle attachment	6 nos
28	Micro meter outside 0 to 25 mm, least count 0.01 mm	2nos
29	Micro meter outside ball type 0 to 25 mm, least count 0.01 mm	1no
30	Depth Micrometer range 0 to 150 mm with 6 depth rods, least count 0.010 mm	1 no
31	Glass drill bit Diamond drilling bits size 5mm, 6 mm,8mm and 10 mm (consumable)	12 each

32	Glass cutter (consumable)	12 nos
33	Diamond cutter	12 nos
34	Circular cutter for glass cutting	6 nos
35	Electric heater for heating glasses.	3 nos
36	Glass plain 3 mm,5mm, 10 mm thick	As required
37	Granite Surface Plate, grade 0, 630 x 630 x 100mm with adjustable stand	1 no
38	Glass Tray	4 nos.
39	Wash basin, Measuring Jars, Jelt Brushes and balance	1 set
40	Glass sheet 3 mm	As required
41	Glass sheet 5.5 mm	As required
42	Chemical paints and Varnish	As required

C. **GENERAL MACHINERY / EQUIPMENT**

1.	Drilling Machine Pillar type 0-12 capacity with motorized	1 no.
2*	Automatic beveling machine	1 no
3*	Surface polishing machine	1 no
4*	Bevel polishing machine	1 no
5*	Spray gun with air compressor with 3 HP Motor	1 no

* one machine for four units

(I) **For Glass Spherical**

1.	Bench Grinder 250 mm dia. (Lighter type)	1 no.
2.	Spherical Generator	1no.
2.	Two Spindle Spherical Smoother & Polisher	2 nos.
4.	Single Spindle Hand Operator Machine	1 no.
5.	Spherical Tools (C.I.Casting)	150 nos.
6.	Spherical Aluminum Runner	40 nos.
7.	Thickness Glass	1 nos.
8.	Spherometer Set (+ & -)	1 nos.
9	Rim less nose plier	12 nos
10	Nose plier	12 nos
11	Bold Nut Nose Plier	12 nos
12	CR Lens Cutter	12 nos
13	Lens Drilling machine, Piller type 12 mm Capacity	1 no
14	Lens Grooving machine	2 nos
15	Lens Format cutting machine	2 nos
16	Lens Axis Marking Chart machine	2 nos
17	Lens Grinding machine Opto lab	2 nos
18	Spectacle Frames - metal	24 nos
19	Spectacle Frames-supra	24 nos
20	Spectacle Frames-rim less	24 nos
21	Spectacle Frames-shell frame	24 nos
22	UV Rays detection machine	1 no
23	Photo chromatic detection	1 no
24	Polarization detection picture	1 no

(II) For Cylindrical

1.	Toric Generator	1 no.
2.	Pneumatic Auto System Cylindrical Smoother & Polisher	2 nos.
3.	Alloy Blocker	1no.
4.	Cylinder Tools (Aluminium)	800 nos.
5.	Cylindrical Aluminium Block	50 nos.
6.	Torometer	1 no.
7.	Evalue Gauge (0 – 25)	1 no.
8.	Diameter Reducer	1 no.
9.	Tap Applicator	1 no.
10.	Tool Rack	1 no.
11.	Chiller Unit (with Chiller Tank)	1 no.
12.	Thickness Gauge	1 no.
13.	Fabrication Items	-
14.	Alloy for CR	2 Kgs.
15.	Diamond for CR	1 no.

(III) Measuring / Checking Devices

1	Optical Spherometer	1 no.
3.	Lenso Meter	1 no.
2.	Auto Refractro Meter	1 no.
3	Binacular	1no
4	Retinoscope	1 no
5	Telescope	1no
6	Periscope	1no
7	Microscope	1no
8	Range Finder	1no
9	Theodolites	1no
10	Night Vision devices	1no
11	Slit lamp,	1no
12	Lens frame	5 nos.
13	Optical refraction unit (Chair unit)	1 set
14	Phoropter	1no
15	Lens Tray (plain to -20 and plain to + 20	1set

(IV) For Spectacle Fittings

1	Auto edge M/C	1 no
2	Hand edge M/C	1 no

D. WORKSHOP FURNITURE

SL.NO	NAMES & DESCRIPTION OF FURNITURE	QUANTITY
1.	Wooden Work bench 340x120x75 cm	4
2.	Locker with 6 drawers (standard size)	2
3.	Metal Rack 180x150x45cm	2
4.	Steel almirah	1
5.	Black board and easel	1
6.	Instructor's Desk or table & Chair	1set
7.	Stool	4