SYLLABUS

FOR THE TRADE OF

SURVEYOR

Under CTS/ATS

Revised in 2005

GOVERNMENT OF INDIA
MINISTRY OF LABOUR & EMPLOYMENT (DGE&T)
CENTRAL STAFF TRAINING RESEARCH
INSTITUTE
EN-BLOCK, SECTOR-V, SALT LAKE CITY
KOLKATA-700 091

GENERAL INFORMATION

1. Name of Trade : Surveyor.

2. N.C.O. Code No. : 028, 10, 037, 10, 037, 20

3. Entry Qualification : Pass in 10 Class examination under 10 + 2 system of Education with Science and Maths. Or its equivalent.

4. Duration of Craftsmen Training. : 2 Years

5. Duration of Apprenticeship Training. : 3 Years including 2 Years basic Training.

6. Rebate of Ex- Craftsmen Training. : Full (2 Years)

7. Ratio of Apprentices to Workers : 1 : 4.

NOTE FOR APPRENTICESHIP TRAINING

1. The Practical Training Programme of Apprentices under ATS (Apprenticeship Training Scheme) should be as per the facilities available in the Establishment / Industry.

2. At the end of shop floor training, an apprentice shall appear for a final examination to be conducted at establishment level based on the actual shop floor training received by the apprentices. This examination shall comprise of assessment of work diaries maintained by the apprentices and Viva Voice to be conducted by an external examiner (other than an official directly responsible for shop floor training).

List of members attended the Trade Committee Meeting for revising the Syllabus for the Trade of Surveyor under CTS/ATS held on 16.06.2005

Sl.No.	Name	Designation/Representing Org.	
	S/Sri		
1.	M.M.Gera	Dy. Director, CSTARI	Chairman
2.	Dr. Arun Kiran Pal	Prof. Deptt. Of Ptg.Engg. Jadavpur University,Kolkata	Member
3.	R. N. Ghosh	Principal, W.B. Survey Instt., Bandel.	Member
4.	P.K. Bose	W.B. Survey & Drg. Employees Association	Member
5.	Prof. U.C.Kumar	NITTTR, Salt lake, Kolkata	Member
6.	Pratul Kr. Goshal	George Telegraph Trg.Instt., Kolkata	Member
7.	Anupam Sarkar	W.B. Survey & Drg. Employees Association	Member
8.	Goutam Kr. Bysak	Council Member, Institution of Surveyors, Kolkata.	Member
9.	Samir Kr. Sengupta	Bidhan Nagar Municipality,SaltLake, Kol.	Member
10.	Dilip Kumar	Sr. Manager Civil, Hindustan Steel Works Construction Ltd., Kolkata	Member
11.	Subrata Saha	Instructor , ITI, Gariahat, Kolkata	Member
12.	Mrs. Manika Banerjee	Instructor, Civil, Don Bosco, Liluah	Member
13.	T.Mukhopadhayay	Dy. Director of Training, CSTARI, Kolkata	Member
14.	S. Kumar	Dy. Director of Training, CSTARI, Kolkata	Member
15.	A.Chakraborty	Asstt. Director of Training, CSTARI, Kolkata	Member
16.	Naren sengupta	Training Officer, RDAT (ER), Kolkata	Member
17.	Swapan Dey	Training Officer, ATI, Kolkata	Member
18.	P.K.Kolay	Training Officer, CSTARI, Kolkata	Member

SYLLABUS FOR THE TRADE OF SURVEYOR UNDER CRAFTSMEN TRG. SCHEME

Period of Training: 2 Years

Week No.	Practical	Trade Theory	Workshop cal. And science
1.	Familiarization with Institute and importance of the trade training. Instruments and equipment used in the trade, type of work done by the trainees in the institute, nature of job done by the trainees of the surveyor.	Importance of safety and general precautions observed in the Institute and in the section. Importance of the trade in development of industrial economy of the country. Related Instructions, subjects to be taught – Achievement to be made. Recreational and medical facilities and other extra curricular activities of the institute (All necessary guidance to be provided to the new comers to be come familiar with the working of industrial training institute, system of including store procedure).	————
2.	Drawing different types of lines, lettering different types.	Uses of Instrument box, board, Tee- Square, Set square, Protractors and other instrument used for survey drawing, their types and uses.	
3.	Printing of letters and figures of different types.	Printing of letters and figures by different methods of inking of letters using stencil, colouring.	————
4 & 5	Construction of plain, comparative diagonal and vernier scales.	Scales – different types, their principle method of construction and reading, calculating least count.	Addition, subs traction of decimal fraction. Multiplication and division of decimal and fraction. Conversion of decimal into vulgar fraction and vice versa.
6,7 & 8.	Geometrical drawing problems on lines, angles, triangles, quadrilaterals etc. Drawing conic section cone.	Geometrical constructions lines, angles, triangles, conic sections, quadrilaterals, polygons, circles, ellipse, parabola & hyperbola.	Fundamental algebraic formula for multiplication.
9 &10	Drawing of conventional signs used in Engineering survey, cadastral survey. Topography and building drawing – practice in map reading including contours and drainage. Use of legends.	Surveying – their classifications, plane survey, geodetic survey , different purpose of survey – instruments used in survey. Nature of surveyors work – importance of system. Accuracy and speed in field and office work. Common terms and definitions used in surveying conventional signs used in	Fundamental algebraic formulae for factorisation.

11.	Practice in unfolding and folding chain, Errors & adjustment of chains, alignment of chain/error chaining lines – measurements of distance between given points and their booking.	field book and survey maps. Use of Legends. Linear measuring instrument used by surveyors, their description and uses. Types of chain.	Simple and simultaneous equations.

ACHIEVEMENT DURING 1ˢᵗ WEEK TO 11 th WEEK :

1. Able to use Drawing instruments, their care and maintenance.
2. Able to layout, display and print in ink, heading and other descriptive writing in a drawing with and without stencils.
3. Able to construct, read and use plain, diagonal and vernier scales.
4. Able to understand and use conventional signs and symbols including contours used in survey drawings and field books.
5. Able to draw and solve elementary problems dealing with lines, angles, triangles, quadrilaterals, etc.
6. Able to draw from given data the various conic sections.

1	2	3	4
12 & 13.	Practice in chaining and taking off-set, use of optical square and cross staff setting out right angles-booking of measurements testing of chain, tape, optical square and cross staff.	Chain survey and principles location of points-off-sets and instrument used for the same, their descriptions testing of the chain, tape, cross staff and optical square.	Simple theory of indices, simple and simultaneous equations.
14.	Procedure in conducting chain survey recognaissance preparation of rough sketch selection of base lines and station points – fixing of stations etc.	Procedure in conducting chain survey – preliminary steps-conditions to be satisfied by survey lines.	Surds. Simple and simultaneous equation of the first degree.
15.	Chain survey of small plots by triangulation, booking and plotting the same.	Field book types-methods of entry of check lines-its importance.	--do--
16.	Chain survey of built up plots, locating details, booking and plotting the same.	Location of details – types of off-sets and their limit- town survey traversing with chain procedure in plotting chain lines skeleton, its check and filling in details.	Quadratic equations and its applications.
17.	Taking horizontal measurements on sloping ground over coming obstacles in chaining and aligning measuring distance between two points one of which is invissible or in-accessible from the other.	Measurements on undulated sloppy ground types of obstacles in chaining and method of overcoming them. Care and maintenance of chain and its accessories.	Quadratic equations and its applications.

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18.	Chain survey of an extensive area, locating details plotting and finishing the same in ink and colour.	Errors in chain survey and their remedies, problems in chain survey-degree of accuracy required in chain survey and its relevant to field work. In field work-procedure in inking and colouring.	----do----
19.	Surveying of a tank, a route or obstructed field by chain traverse, method of finding height of inaccessible objects by using chain and its accessories.	Use of magnetic needle in survey works – types of compasses – description, constructional features and uses of surveyor's compasses and their adjustment measurement of directions.	Linear graph. Use of common logarithims tables.
20.	Achievement test in chain survey.	Discussion of evaluation scripts.	----do----

ACHIEVEMENT AFTER 12th WEEK TO 20th WEEK ---- The trainees will be ----

1. Able reconnoiter prepare rough sketch, plan the survey lines, select stations fix the stations for a given plot of ground.
2. Able to run a chain line between two given stations measure the distance, take off-sets by using tape, use of optical square or cross staff and enter in the field book using proper conventional sign and plot the same.
3. Able to survey by chain a given plot of ground by enclosing the details in triangles and enter the same in the field book including running necessary check lines and plot the same.
4. Able to find horizontal distance along sloping or irregular ground.
5. Able to run chain lines obstacles for ranging, chaining or both.
6. Able to survey with a chain a given area of about 4 hectares by tracing base line and triangles, enter the field book and plot the same.

COMPASS SURVEY

21.	Practice in setting up a compass and checking its accuracy – taking bearings and calculating angles.	Technical terms used in compass survey, difference between angles and bearings-magnetic and true meridians-declination and its variations, local attraction, its detection, and elimination.	----do----
22. &23.	Determining the bearings of a given line and establishing lines of given bearings – laying out a recti-linear and –polygonal plots of ground using a compass and a tape.	Method of locating details by bearings, method of survey with compass- traversing methods. Methods of determining true meridians and declination – methods of plotting closed compass traverse – adjustment of closing errors – limits of precision required – field book entries.	Linear graph. Uses of common logarithmic tables.
24.	Conducting closed traverse of built up fields and plotting the same.	Relaying of old service errors in compass survey. Testing and adjustment of compass.	Properties of plain geometrical figures – triangles, rectangle and quadrilaterals.
25 & 26.	Surveying and extensive built up area with compass booking plotting –finish in ink and colour.	Plane table survey advantage and dis-advantages of plane table survey-equipment in plane table surveying, general instruction for plane table survey.	----do----

ACHIEVEMENT AFTER 21st WEEK TO 26th WEEK :-   The trainees will be ---

1.   Able to set up the prismatic compass at a station and read bearings of various objects around it.
2.   Able to run an open and closed traverse, check existence of local attraction, calculate included angles and check the angular accuracy.
3.   Able to plot the frame work with protractor and scale, adjust the closing errors, plot the details, finish the same in ink and colour.
4.   Able to find the declination of a place by simple methods.

PLANE TABLE

27.	Setting up of plane table leveling, centering and orientation.	Methods of plane tabling – radiation – intersection – traversing – resection.	Properties of regular polygons, circles parallelogram, parabola and ellipse.
28.	Surveying an area with plane table by radiation and intersection methods.	Two point and three point problems triangle of error and its elimination – Lehman's rule – mechanical and graphical method	----do----
29 & 30.	Traversing with plane table of built up areas.	Errors in plane tabling and their elimination instruments used in combination with plane tabling, their construction and use.	Determination of sides, area of triangle, quadrilateral & polygons.
31.	Running and open traverse with plane table and fixing details.	Tangent clinometers (Indian pattern clinometer), Delescles clinometer, telescopic alidade.	----do----
32.	Inking, finishing, colouring and tracing of plane table maps done in previous weeks	--------do--------	----do----
33. & 34.	Practice in finding the position of the table by three point and two point problems and locate. Use of tangent clinometer-Dolesole' s clinometer- Abney level for finding height of various surrounding points – use of telescopic alidade in fixing heights of surrounding points.	Survey maps – care and maintenance at plane table accessories, procedure of plane tabling.	----do----

ACHIEVEMENTS AFTER 27th WEEK TO 34th WEEK :-- The trainees will be ---

1.   Able to set up a plane table over a station, level, centre and orient it and draw rays to various surrounding objects.
2.   Run an open or closed traverse with plane table, fix details by radiation and intersection.
3.   Find the position of station occupied by the table by three points and two point's problems.
4.   Prepare ------ books from plane table survey maps.

LEVELING

1	2	3	4
35.	Practice in setting out a level and performing temporary adjustments – practice in reading staff.	Leveling survey – the level parts, kinds – types of levels – Cook's reversible level and dumpy level – their construction and parts – types of diaphragm. Types of leveling staff, their description and use-technical terms used in leveling.	Determination of area of circles, sectors, segments and ellipse, Simpson's Rule.
36.	Demonstration of permanent adjustment of level	Permanent adjustment of various leveling instruments, repeating the same with precautions.	----do----
37 to 40.	Practiced in differential leveling, including reciprocal leveling and establishing bench marks, reading of inverted staff practice in booking, and reduction checking level reading in height of collimation and rise and fall systems.	Methods of observation, booking and reduction of levels, forms of levels, forms of field books for leveling and methods of entry rules for checking up readings and calculation. Reciprocal leveling – effect of earth's curvature and refraction in leveling. Common sources of errors in leveling and their elimination-degree of accuracy in leveling. Introduction to contour.	Surface area and volumes of rectangular parallelopoids, cylinders, pyramids and spheres. Units of force and weight. Equation of motion.
41 & 42.	Performing permanent adjustment to various types of leveling instruments.	Working out problems on field book reduction, reciprocal leveling and permanent adjustments.	Magnet and magnetism. Laws of magnetic attraction and repulsion.

ACHIEVEMENT AFTER 35th WEEK TO 42nd WEEK:-- The trainees will be----

  1.   Able to set up a level, do the temporary adjustments and read the staff.
  2.   Able to find correctly the difference of level between two points which are about 6 kms. Apart with various obstacles on the way such as river, high compound wall etc. Establish bench marks in the way and enter the reading in the field book, reduce and check the same in height of collimation and rise and fall system.
  3.   Able to perform the permanent adjustment of a level.

43.	Establishing of alignment and grade for roads and drains. Method of entering in the field books.	Classification of leveling staffs. Purpose of sectioning, consideration of distance between points, precautions.	Magnetic substance – permanent magnet.
44 to 46.	Carrying out route survey longitudinal & cross section of a road project – its ploting and calculation of earth work.	Steps in plotting sections – selection of scales – factors affecting selection of formation level – prismoidal formula and its application, calculation of earth work.	Magnetic field and line of force proportions, of magnetic lines of force.
47.	Practice in use of boning rods and ghat tracer for establishing grade lines for various types of work.	Construction and use of boning rods and ghat tracer.	Magnetism and its natural ore.

48 to 50	Road project – reconnaissance, preliminary and final location survey including preparation of route map to scale, taking profile and section with level plotting, marking formation levels- calculation of earth work and other materials for laving road including estimation of earth work.	Types of surveys for the location of a road, points to be considered during reconnaissance, preliminary and final location surveys. Alignment of roads – relative importance of length of road height of embankment and depth of cutting – road gradients – sub grades and road foundations, drainage camber curves and super elevation, road surfaces, such as earth road, water bound macadam cement contrete payment	Kinds of magnet and system of magnetization. Revision on magnetism. Trigonometrically ratios and functions of multiple angles functions of sub-multiple angle and compound angles radian measurement and relation between system of measurement of angles – formula connecting sides, angles and areas of triangles.

<u>ACHIEVEMENT FROM 43rd WEEK TO 50th WEEK :-</u> The trainees will be --

1. Able to run longitudinal and cross section for a road or canal project, repairs for a tank bunds, plot the profiles, make proposal for cutting and embankment and calculate the same including preparation of route survey map.
2. Able to use ghat tracer and boning rods for setting out given slopes.

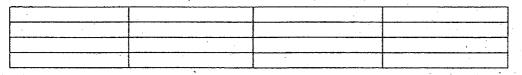|		
51 & 52	Practice in setting up a theodolite and taking readings.	Introduction to theodolitye. Temporary adjustment of theodolite-procedure in setting up – methods of measurement of horizontal angles – repetition and reiteration systems .	Solution of simple triangles.
53 & 54	Measurement of horizontal angles by repitition, reiteration methods – method of entering the same in the field book – setting out given angles.	General forms of field notes used in theodolite surveys – adjustment of errors while laying a given angle by repitition. Method of setting out straight lines establishing lines at given angles with given lines.	Solution of simple triangles.
55.	Practice in measuring vertical angles, setting out given vertical angles and entering in the field book.	Instrumental errors and—- elimination – permanent adjustments of theodolite care and maintenance of theodolites.	Problems on height and distance.
56.	Demonstration of permanent adjustment of theodolite.	Method of running a traverse – different methods of angles and bearings.	---do----
57 & 58.	Setting out a straight line over and across obstacles prolonging straight lines establishing lines at given angles with given lines – setting out on around given recti-linear figures.	Methods of plotting traverses – Gales traverse system-checking of measurements of closed and open traverse-use of traverse tables (chambers and boilean) closing errors and its adjustment.	Use of mathematical tables.
59.	Running a closed traverse over a given area,	Omitted measurements and their calculation – practice in	Revision of trigonometry.

	booking calculating the coordinates and plotting the traverse.	working out problems.	
60.	Running an open traverse, calculate and plot the same and fix the details with plane table measuring a base line for triangulation.	Technical terms in connection with simple triangulation – base line measurements and its correction – procedure of measuring angles – methods of calculating sides from triangulation, data check, errors and precautions.	Surface area and volumes of cylinders.
61.	Practice in performing permanent adjustments of theodolite.	Methods of calculating area of a closed traverse from coordinates.	Surface area and volumes of prisms. Prisomoidal formula.
62.	Finding height and distances of accessible and inaccessible objects with theodolite and chain and calculating the same, use of box sextant.	Working out problems on finding out areas of closed traverses, height and distances – box sextant, its description and use. Abney' s level and its description.	Surface area and volumes of pyramids, prisomoidal formula.

63.   **ACHIEVEMENT TEST ON THE THEODOLITE AND REVISION OF 53 WEEK. TO 65 WEEK.**

ACHIEVEMENTS FROM 51ST WEEK TO 63RD WEEK: – The trainees will be --

1.   Able to set up a theodolite over a station, read a round of angles by repetition and reiteration, enter the same in the field book.
2.   Able to prolong a straight line with a theodolite.
3.   Able to run a closed traverse with a theodolite and steel tape or chain, enter the same in field book, calculate the coordinates of stations by Gales traverse system adjustments and plot the same, fill interior details by plain table survey and find the area of the closed traverse from coordinates.
4.   Able to run and open traverse .
5.   Able to find out heights of two in-accessible objects and their distance from each other by theodolite observation.

Contouring of Topographic Survey :

64.	Countouring by spot level method including interpolation.	Topographic survey and principle – instruments and accessories used in topographic survey – contours and their characteristics.	Surface area and volumes of sphere.
65.	Countouring by cross – section method including interpolation of contours (Grid method).	Vertical intervals horizontal equivalents methods of determining counters – comparison of different methods and their application.	Surface area and volumes of cone.
66.	Direct contouring using levels for vertical control, plane table and telescopic alidade for horizontal control.	Interpolation of contours by different methods and preparing contour maps – preparation of field record for topographic surveys – height book – height tracing and colour trace.	Revision of whole mensuration work.
67-68	Conducting topographic survey of undulated area by theodolite triangulation and plane table resection and intersection method using Indian pattern clinometer.	Different methods of finding area of irregular figures – planimeter – its principle, construction, use of precautions – working out problems of areas by using planimeter enlarging and reducing of plans use of proportions, compass and pantographs and their parts.	Elementary theory of light.
69.	Carrying out topographical survey with the help of theodolite level and tape of a site of reservior cross sectional drawing of different canals.	**Irrigation :-** Types of supply of water – rain fall attachment areas, run off over best site for construction a reservior, water spread area factors affronting the consideration of the height of dam and capacity of reservior.	Laws of reflection, refraction mirrors and lens.. Properties of mirrors and lenses, acromatic combination of lenses, description and use of optical instruments such as telescopic sextants etc.
70 to 72	Survey camp:- In any suitable hilly place 3 week. Carrving out contour Direct an indirect contour survey of a small area by tachometer – working out proposed alignments on contoured maps (project work) on various curves and calculation, marking of alignment of road on it. Direct contour and Indirect contour.	——do———	——do——

ACHIEVEMENT :-- The trainees will be –
1. Able to contour an area by spot levels, cross level methods and by simple tachometry and interpolute the contours.
2. Able to use of Indian pattern clinometer abney level, telescopic alidade in conjunction and with plane table and theodolite to carry out topographic survey.
3. Able to set out a simple curve by chain and off-set methods and deflection methods with and without obstacles.
4. Able to set out compound and transition curves with theodolite.
5. Able to use planimeter and pantographs.
6. Able to set out a vertical curve.

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73.	Setting out of simple curves by chain and tape with different methods setting out of curves by deflections methods with and without obstacles.	Working problems on simple curves by chain and tape offset method and successive by section of arch.	Properties of mirrors and lenses, acromatic combination of lenses, description and use of optical instruments such as telescope sextants etc.
74.	Setting out of compound curves, transition curves with theodolite.	Compound curves working problems on compound curves and types of transition curves.	----do----
75.	Setting out of verticle curves.	Different types of verticle curves and its working problems. Parts of pantigraphs and planimeter with their uses.	------do-----
76.	Reducing and enlarging the plan by pentagraph and area by planimetre		-----do-------
77 to 78	Measurement off- set of obstructed lines, measurement of field both in the triangle and off-set system base line system, fixing, missing, land demarcation.	Methods of taking off-sets on obstructed lines and offset lines, field measurement in triangle and offset system. Method of fixing survey maps on boundaries.	Some common terms from astronomy essential for surveyor.
79 to 80	To find the true north by transfer to camp observing stars and sun (current) with the help of Nautical Almanac. (Camp is preferable)	Astronomical surveying introduction. Definition of spherical triangle. Astronomical triangle observation of sun and stars. Calculation for Azimuth and time. Coordinate System and its conversion of mean solar time into side real time or vice versa. Determination of the meredian and Azimuth.	Load, elongation, stress and strain, hook' s law.

ACHIEVEMENT TEST :-- The trainees will be –
   1. Able to study the photographic and aerial survey.
   2. Able to find the true north by observing stars and sun.

CADASTAL SURVEY :--

81.	Testing plotting of (1:4000) village map and locating errors in measurements.	Procedure in typing field numbers, printing names and inter-setting topographical details in maps.	Modulus of elasticity elastic limit and yield point.
82.	Typing field numbers, printing names and inserting topographical detail in maps-comparison of field and village boundaries and side measurements.	Comparison of field and village boundaries and side measurements procedures to prepare of transfer paper and transfer drawings-Lithography – incography Vandyke process, cordography.	Ultimate stress and breaking stress. Problems on the above.
83.	Tracing and inking taluk, district and state maps – Grossery of terms tracing of maps – observation of substance bar and its calculation.	Convergency of meridian – substance bar and its use. Grossery of terms.	Binding moment, shear force their definitions and calculations thereof.

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84-85.	Azimuth observation and computation-Computation of latitudes and azimuths, Solution of spherical triangle. Record of Rights.	Computation of latitudes and azimuth, solution of spherical triangles – computation of spherical triangles, values of village tri-junctions, maps-projection methods of reducing values of points from one origin to other. Land laws & rules.	Bending moment, shear force their definitions and calculations thereof.
86 to 92.	i) Elementary (Window operating system) ii) Knowledge of Editor. iii) How to install Auto-CAD. iv) How to load Auto-CAD v) Elementary command of Auto-CAD vi) Knowledge of window software, vii) M.S.Office. viii) Operating system Software ix) Working practice on Auto-ACD x) Latest survey software	i) What is computer. General terms used in computer. ii) MS-Word and their uses. iii) M.S.Office. iv) Operating System Software v) Window command and their uses. vi) Auto CAD Commands and use of different Menus of Auto-CAD	——Do——
93.	Types of bonds plan section and elevation of 115 mm and 340 mm thick wall detailed drawing of parts of a building such a brick arch stone masonry. Drawing of king and queen posts trusses, simple doors and simple RCC structural parts.	Types of bonds, English bond, Flemish bonds, Tee joints, wall junctions, stone masonry, random rubble, coarsed and Aslar stone masonry. Type of Arch, king post and queen post, doors & windows RCC simple beems and lintel.	Different units conversion of units of Areas, volumes & relating related to surveying.
94 to 95.	Drawing plan elevation and section of simple building simple building by measurements, plan section and elevation.	Glossary terms of building construction and building materials.	Estimation of simple building.
96 to 97.	Setting out a simple building and simple culvert on the ground from given drawing	Glossary terms of roads irrigation.	——do——

98 to 99. The trainees should visit some project with their trainer together the correct ideas about survey project and its importance in the society. The trainee should also evaluate the approximate cost for a project work.

100 to 101 Estimating and costing for a simple building in details and specification for different works.

102. Total station survey (Digital Theodolite)

103 to 104. **Revision and Final Trade Text.**

ACHIEVEMENT : - The trainees will be ---

1. Able to measure both in the triangular and off-set system and base line system with and without obstruction.
2. Able to demarcate partition and fixing missing survey stones.
3. Able to survey and block of 16 hectares of land containing several fields, subdivisions and running of purtal lines.
4. Able to plot from field measurements, field and village maps in different scales with plotting scale, off-set and rectangular coordinate system.
5. Able to type field nos. print names and insert topographical details.
6. Able to observe and compute azimuth solution of spherical triangles.
7. Able to apply the general provision of the survey and boundary acts and rules under the state.

ACHIEVEMENT FROM 92nd WEEK TO 101st WEEK: --- The trainees will be---
1. Able to prepare plan and section of 115 mm. 225 mm and 340 mm thick walls in different bonds.
2. Able to prepare detailed drawings of parts of a building such as brick arches, stone masonry walls king and queen posts truses- simple doors and simple R.C.C. structural parts.
3. Able to draw from given sketches-the plan, elevation, section of simple buildings and simple culvert and set them out on the ground.

FINAL ACHIEVEMENT :-- The trainees will be---
1. Able to plan the survey of an extensive area and conduct the same with chain, prismatic compass, plane table or theodolite with an error of 5% or less.
2. Able to enter the above in appropriate field books, make the necessary calculations. Plot the same and finish in ink and colour.
3. Able to do fly leveling with an error of .03 per k.m. Establish benchmarks, enter the field book reduce and check the same.
4. Able to carry lout topographic survey of an extensive undulated area with plane table, resection method, in combinat on with Indian pattern Clinometers, Abney level etc.
5. Able to contour a given undulated area by spot level such as a site for reservoir and interpole the contours.
6. Able to prepare proposals for laying a road or canal including preparation of site plan longitudinal cross sections, calculate the depth of cutting an height of embankment after proposing formation level.
7. Set out a simple compound, reverse, vertical and transition curves from given data.
8. Able to set out a building or culvert from given drawing.
9. Able to set out a given gradient by method of gnat tracer and boning rods.
10. Able to plot from given field book the plan of a given area, finish it in it ink and colour, trace and prepare Ferro-print enlarge and reduce the same to required scale.
11. Able to find the area of given plot.
12. Able to survey of a block of 10 hectares of land containing several fields, subdivisions and prepare field measurement books demarcation sketch and connected records
13. Able to prepare field and village maps in different scale.
14. Able to observe and compute azimuth.
15. Able to prepare a detailed drawing of simple building or culvert from given sketch or specifications.
16. Able to find the true North by observing sun and stars.
17. Able to conduct the cadastral survey and plot it in the sheet as per provisional settlement map.
18. Able to operate the computer, DOS, CAD , Auto cad etc.

LIST OF TOOLS AND EQUIPMENT FOR A BATCH OF SIXTEEN TRAINEES.

Sl. No.	Description of material	Quantity
1.	Abney level	1 No.
2.	Ammonia printing box	1 No.
3.	Box sextant	2 Nos.
4.	Boning rod	1 Set.
5.	Binocular	4 Nos.
6.	Box drawing instrument containing compass with pencil point, point divider interchangeable, divider pen point interchangeable, divider spring box, pen spring box, lengthening bar, pen drawing lines, screw divider instrument, tube with leads.	17 Nos.
7.	Black Board with Easel	
8.	Cup board (major)	1 No.
9.	Calculators (8 digits)	8 Nos.
10.	Chisels steel 80 mm blade	17 Nos.
11.	Computing scales two hectares	4 Nos.
12.	Computing scales five hectares	4 Nos.
13.	Card bard scales (8 in one box)	4 Nos.
14.	Celonghattracer	16 boxes.
15.	(a) Cross staff wooden box type	2 Nos.
16.	(b) Cross staff wooden open type	2 Nos.
17.	Drawing board (Imperial size)	17 Nos.
18.	Drawing machine (Horizontal)	4 Nos.
19.	---do---- Table	16 Nos.
20.	Engineer's chain	1 No.
21.	(a)Engineer' s level	1 No.
	(b) Dumpy level	5 Nos
	© Cokes reversible level	5 Nos
	(d) Tilting level	2 Nos.
22.	Erasing shield	1 No.
23.	French curve plastic (set of 12)	16 Nos.
	(a)Ferro printing frame, 450 x 600 mm	4 Sets.
24.	(b) Ferro printing frame, 800 x 600 mm	1 No.
25.	Fire extinguisher	1 No.
26.	Grunters chain	2 Nos
27.	Hand press for numbering and lettering	5 Nos.
28.	Haversacks (canvas bag for keeping tools), (Survey of India Pattern)	1 No.
29.	Height Indicators (Survey of India Pattern)	8 Nos.
30.	Hold all canvas for instruments (S.O.I.)	8 Nos.
31.	Hones in case (Survey of India)	8 Nos
32.	Instructors chair	1 No.
33.	Instructors table	1 No.
34.	Light tracing board fitted glass, Lamp and frame	4 Nos.
35.	Leveling staff telescopic	1 No.
36.	Metric chain (30 M & 20 M)	10 Nos.
37.	Magnifying glass	5 Nos. each
38.	Magnet bar (for magnetizing through compass needles)	2 Nos.
39.	Metal tubes for keeping drawings dia. 100 mm and 1 meter long	1 Set.
40.	Pen knife	8 Nos.
41.	Protractor full circle (Plastic 150 mm dia)	16 Nos.
42.	Proportionate compass	16 Nos.
43.	Plan meter (Digital)	16 Nos.
44.	Pantograph	2 Nos.
	Prismatic compass	2 Nos.

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45.	(a) Plane table with stands with waterproof cover	5 Nos.
	(b) Alidade	4 Nos.
	(c) Through compass (Compass beam wooden)	4 Nos.
	(d) Plumbing fork with bobs	8 Nos.
	(e) Telescopic alidade	8 Nos.
	(f) Indian pattern clinometer	8 Nos.
46.	Ranging rods 4 M	32 Nos.
47.	Off-set rod	4 Nos.
48.	Optical square	4 Nos.
49.	Railway curves	4 Nos.
50.	Steel Almirah (major)	1 Set.
51.	Stool for drawing tables	6 Nos.
52.	Scales diagonal, electroplated	16 Nos.
53.	Survey platting scales with off-set bits (8 in a set)	1 No
54.	Stencil set in complete box	16 Nos.
55.	Substance bar	2 Nos.
56.	Set squares (45 ' & 60' Plastic 280 mm)	2 Nos.
57.	Tapes :-	17 pairs
	a) Metallic tape 30 M	10 Nos.
	b) Metallic tape 20 M	10 Nos.
	c) Steel tape 30 M	2 Nos.
	d) Steel band 30 M & 20 M	2 Nos. each
58.	Tee square	17.Nos.
59.	Surveyors umbrella	8 Nos.
60.	a) Theodolite transit	4 Nos.
	b) Micrometer Theodolite transit	1 No.
61.	Traverse staff (Survey of India)	1 No.
62.	Rules Ebonite plain for drawing lines	16 Nos.
63.	Zinc tray (for washing prints)	1 No.
64.	Wooden set squares Tee-Square and compass for black board work.	1 Set.
65.	Computer & Software	
66.	Total station (Digital Theodolite)	1 No.
	For educational purpose.	

9) **Elementary Hydraulics:-**

Pressure of a fluid, pressure head of fluid, total pressure in a surface, centre of pressure, elementary idea of hydraulic press, hydraulic jacks. Flow of fluids -- velocity and total heads of fluids -- venturimeter, flow through orifices and mouths with various co-efficient- loss of head due to friction and other factors of following -- fluid flow through pipe lines and open channels.

NOTE:-   (i)   The content of syllabus for workshop science and calculation during the first year and second year shall be exactly the same as that of the first year and second year respectively Craftsmen Training Scheme of Gol. of India.

(ii)   Syllabus for workshop science & Calculation is given here only for the third year. This is also based on the syllabus for the first two year portion.

4.   **SOCIAL STUDIES:--**
The syllabus has already been approved and is same for all trades.

NOTE :--(a) For Basic Training (I st. & II nd. year)- same syllabus as under CTS should be followed.
(b) For shop Floor training (3rd year) the above ATS syllabus given here is to be followed.

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UNDER

APPRENTICESHIP TRAINING SCHEME

Period of Training :- 3 years

(One-year course after completion of two years Basic Training)

SUBJECTS :-

1 TRADE PRACTICAL :-

1. Survey/ Modern survey
2. Geodesy.
3. Astronomical survey.
4. Engineering project survey
5. Photogrametry
6. Knowledge about the Geographic Information system total station (Digital thodolite)

2. TRADE THEORY :

1) Choice of stations, triangle, quadrilaterals, inter-related polygons.
2) Spherical trigonometry.
3) Celestial sphere, astronomical terms, different system of coordinates, corrections, determination of latitude, longitude, meridian and solar time sidereal.
4) General principles, under laying survey methods used for road, railway and canal alignments, topographical survey, city survey.
5) Principles of aerial survey stereoscopy and rectification.

3. WORKSHOP SCIENCE & CALCULATION : "

1) Revision of syllabus of previous years.
2) Theory of indices, surds, quadratic equation.
3) Determination of area of sectors segments, ellipse, irregular figures, surface area and volumes of pyramids, cones, sphere-their frusta including prismodal formula.
4) Solution of triangles and problems of height and distance.
5) Calculation on moments, centre of gravity, moments of inertia and modulus of section for simple sections. Calculation and drawing of B.F. diagrams for simple supported beams and cantilevers with concentration and uniformly distributed loads, selection of steel joints, from hand books for given loading.
6) Use of slide rule and pocket electronic calculator.
7) Calculation of material and cost from working drawing.
8) Electricity-units-quantities-laws of electricity brief description working principle and function of a generator, calculation of currents, voltage, resistance in series and parallel D. C. and A. C. Motor & Transformers.

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