SURVEYOR

NSQF LEVEL - 6

SECTOR- CONSTRUCTION

COMPETENCY BASED CURRICULUM

CRAFT INSTRUCTOR TRAINING SCHEME (CITS)

GOVERNMENT OF INDIA
Ministry of Skill Development & Entrepreneurship
Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City, Kolkata – 700091

SURVEYOR

(Engineering Trade)

SECTOR – CONSTRUCTION

(Revised in 2019)

Version 1.1

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Developed By
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CONTENTS

1. COURSE OVERVIEW

The Craft Instructor Training Scheme is operational since inception of the Craftsmen Training Scheme. The first Craft Instructor Training Institute was established in 1948. Subsequently, 6 more institutes namely, Central Training Institute for Instructors (now called as National Skill Training Institute (NSTI)), NSTI at Ludhiana, Kanpur, Howrah, Mumbai, Chennai and Hyderabad were established in 1960 by DGT. Since then the CITS course is successfully running in all the NSTIs across India as well as in DGT affiliated institutes viz. Institutes for Training of Trainers (IToT). This is a competency based course for instructors of one year duration. "Surveyor" CITS trade is applicable for Instructors of "Surveyor" CTS Trade only.

The main objective of Crafts Instructor training programme is to enable Instructors explore different aspects of the techniques in pedagogy and transferring of hands-on skills so as to develop a pool of skilled manpower for industries, also leading to their career growth & benefiting society at large. Thus promoting a holistic learning experience where trainee acquires specialized knowledge, skills & develops attitude towards learning & contributing in vocational training ecosystem.

This course also enables the instructors to develop instructional skills for mentoring the trainees, engaging all trainees in learning process and managing effective utilization of resources. It emphasizes on the importance of collaborative learning & innovative ways of doing things. All trainees will be able to understand and interpret the course content in right perspective, so that they are engaged in & empowered by their learning experiences and above all, ensure quality delivery.

2. TRAINING SYSTEM

2.1 GENERAL

CITS courses are delivered in National Skill Training Institutes (NSTIs) & DGT affiliated institutes viz., Institutes for Training of Trainers (IToT). For detailed guidelines regarding admission on CITS, instructions issued by DGT from time to time are to be observed. Further complete admission details are made available on NIMI web portal http://www.nimionlineadmission.in. The course is of one-year duration. It consists of Trade Technology (Professional skills and Professional knowledge), Training Methodology and Engineering Technology/ Soft skills. After successful completion of the training programme, the trainees appear in All India Trade Test for Craft Instructor. The successful trainee is awarded NCIC certificate by DGT.

2.2 COURSE STRUCTURE

Table below depicts the distribution of training hours across various course elements during a period of one year:

S No.	Course Element	Notional Training Hours
1.	**Trade Technology**	
	Professional Skill (Trade Practical)	640
	Professional Knowledge (Trade Theory)	240
2.	**Engineering Technology**	
	Workshop Calculation	120
	Workshop Science	80
3.	**Training Methodology**	
	TM Practical	320
	TM Theory	200
	Total	**1600**

2.3 PROGRESSION PATHWAYS

- Can join as an Instructor in a vocational training Institute/ technical Institute.
- Can join as a supervisor in Industries.

2.4 ASSESSMENT & CERTIFICATION

The CITS trainee will be assessed for his/her Instructional skills, knowledge and attitude towards learning throughout the course span and also at the end of the training program.

a) The Continuous Assessment (Internal) during the period of training will be done by **Formative Assessment Method** to test competency of instructor with respect to assessment criteria set against each learning outcomes. The training institute has to maintain an individual trainee portfolio in line with assessment guidelines. The marks of internal assessment will be as per the formative assessment template provided on www.bharatskills.gov.in

b) The **Final Assessment** will be in the form of **Summative Assessment Method**. The All India Trade Test for awarding National Craft Instructor Certificate will be conducted by DGT at the end of the year as per the guidelines of DGT. The learning outcome and assessment criteria will be the basis for setting question papers for final assessment**.** The external examiner during final examination will also check the individual trainee's profile as detailed in assessment guideline before giving marks for practical examination.

2.4.1 PASS CRITERIA

Sl. No.	Subject		Marks	Internal assessment	Full Marks	Pass Marks	
						Exam	Internal assessment
1.	Trade Technology	Trade Theory	100	40	140	40	24
2.		Trade Practical	200	60	260	120	36
3.	Engineering Technology	Workshop Cal.	50	25	75	20	15
4.		Workshop Sc.	50	25	75	20	15
5.	Training Methodology	TM Practical	200	30	230	120	18
6.		TM Theory	100	20	120	40	12
Total Marks			**700**	**200**	**900**	**360**	**120**

The minimum pass percent for Trade Practical, TM practical Examinations and Formative assessment is 60% & for all other subjects is 40%.There will be no Grace marks.

2.4.2 ASSESSMENT GUIDELINE

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking the assessment. While assessing, the major factors to be considered are approaches to generate solutions to specific problems by involving standard/non-standard practices.

Due consideration should also be given while assessing for teamwork, avoidance/reduction of scrap/wastage and disposal of scrap/waste as per procedure, behavioral attitude, sensitivity to the environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising of the following:

- Demonstration of Instructional Skills (Lesson Plan, Demonstration Plan)
- Record book/daily diary
- Assessment Sheet
- Progress chart
- Video Recording
- Attendance and punctuality
- Viva-voce
- Practical work done/Models
- Assignments
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming yearly examination for audit and verification by examining body. The following marking pattern to be adopted while assessing:

Performance Level	Evidence
(a) Weightage in the range of 60%-75% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of an ***acceptable standard*** of crafts instructorship with ***occasional*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***fairly good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Average engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A fairly good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Occasional support in imparting effective training.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***reasonable standard*** of crafts instructorship with ***little*** **guidance** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***good*** skill to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Above average in engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A good level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Little support in imparting effective training.
(c) Weightage in the range of more than 90% to be allotted during assessment	

For performance in this grade, the candidate should be well versed with instructional design, implement learning programme and assess learners which demonstrates attainment of a ***high standard*** of crafts instructorship with ***minimal or no support*** and engage students by demonstrating good attributes of a trainer.	• Demonstration of ***high*** skill level to establish a rapport with audience, presentation in orderly manner and establish as an expert in the field. • Good engagement of students for learning and achievement of goals while undertaking the training on specific topic. • A high level of competency in expressing each concept in terms the student can relate, draw analogy and summarize the entire lesson. • Minimal or no support in imparting effective training.

3. GENERAL INFORMATION

Name of the Trade	**SURVEYOR – CITS**
Trade code	DGT/4017
Reference NCO 2015	2165.0200, 2356.0100
NSQF Level	Level-6
Duration of Craft Instructor Training	One Year
Unit Strength (No. Of Student)	25
Entry Qualification	Diploma/Degree in Civil/Construction Engineering from AICTE recognized Board / University. OR National Trade Certificate in the Surveyor trade or related trade. OR National Apprenticeship Certificate in Surveyor trade or related trade.
Minimum Age	18 years as on first day of academic session.
Space Norms	Class room - 30 sq. m Drawing Hall: 100 sq. M
Power Norms	Class room - 1 KW Drawing Hall - 5.5 KW
Instructors Qualification for	
1. Surveyor - CITS Trade	B.Voc/Degree in Civil /Construction Engineering from AICTE/UGC recognized University with two years experience in relevant field. OR 03 years Diploma in Civil/Construction Engineering from AICTE/ recognized Board/ University or relevant Advanced Diploma (Vocational) from DGT with 5 years experience in relevant field. OR NTC/NAC passed in the trade of Surveyor with CITS and seven years post qualification experience in relevant field. **Essential Qualification:** National Craft Instructor Certificate (NCIC) in Surveyor Trade, in any of the variants under DGT.
2. Workshop Calculation & Workshop Science	B.Voc/Degree in any Engineering discipline from AICTE/ UGC recognized Engineering College/ university with two years experience in relevant field. **OR** 03 years Diploma in any Engineering discipline from AICTE /recognized board of technical education or relevant Advanced Diploma (Vocational) from DGT with five years experience in relevant field. **OR** NTC/ NAC in any Engineering trade with seven years experience in relevant field.

	Essential Qualification: National Craft Instructor Certificate (NCIC) in relevant trade OR NCIC in RoDA or any of its variants under DGT
3. Training Methodology	B.Voc/Degree in any discipline from AICTE/ UGC recognized College/ university with two years experience in training/teaching field. OR Diploma in any discipline from recognized board / University with five years experience in training/teaching field. OR NTC/ NAC passed in any trade with seven years experience in training/teaching field. Essential Qualification: National Craft Instructor Certificate (NCIC) in any of the variants under DGT / B.Ed /ToT from NITTTR or equivalent.

Distribution of training on Hourly basis: (Indicative only)

Total Hrs /week	Trade Practical	Trade Theory	Workshop Cal.	Workshop Sc.	TM Practical	TM Theory
40 Hours	16 Hours	6 Hours	3 Hours	2 Hours	8 Hours	5 Hours

4. JOB ROLE

Brief description of job roles:

Manual Training Teacher/Craft Instructor; instructs students in ITIs/Vocational Training Institutes in respective trades as per defined job role. Imparts theoretical instructions for the use of tools & equipments of related trades and related subjects. Demonstrate process and operations related to the trade in the workshop; supervises, assesses and evaluates students in their practical work. Ensures availability & proper functioning of equipment and tools in stores.

Topographical Surveyor; surveys land to determine out line, contours and relative position of control points (land marks) on tract of land, coast, harbor, etc. for preparing topographical and other maps and records. Establishes control points and pillars to do instrumentation work on ground to prepare maps. Provides identification marks on ground for photographs taken in aerial survey. Fixes position of control points on ground in relation to some permanent position and with reference to celestial bodies using theodolites and precise levels, tachometer, digital planimeter etc. Adjusts and sets theodolites, compasses, plane tables, leveling instruments, Total station, GPS, DGPS and other modern instruments for survey, observes and records measurements and angles from three determined points (triangulation), locations to scale on proper sketch. Corrects margin of error due to worn-out tapes which become incorrect, and readings on instruments which are affected by environmental factors.

Plan and organize assigned work and detect & resolve issues during execution in his own work area within defined limit. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity.

Reference NCO-2015:

a) 2356.0100 - Manual Training Teacher/Craft Instructor
b) 2165.0200 - Topographical Surveyor

5. LEARNING OUTCOMES

Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.

5.1 TRADE TECHNOLOGY

1. Ensure implementation of safe working practices, environment regulation.
2. Resolve the problems occurring in chain survey.
3. Identify the interior details observed by Plane Table survey.
4. Establish the graphical representation on proposed gradient by Levelling and Theodolite survey.
5. Compute and observe topographic map by contour surveying using different equipment.
6. Plan a road project survey.
7. Execute tachometric survey.
8. Conduct topographical survey.
9. Represent and classify different survey instrument using different methods.
10. Execute plotting and estimating by 2D detailed drawing in customized AutoCAD environment.
11. Input conventional signs and symbols as per Survey dimensioning standard.
12. Execute Chain survey.
13. Adopt the procedure of levelling to determine undulation of earth surface.
14. Develop survey concept of roads and railway tracks.
15. Ensure set up of digital theodolite for critical measurement.
16. Determine measuring features for survey using Total Station and GPS.
17. Construct map on AutoCAD workspace.

6. COURSE CONTENT

SYLLABUS FOR SURVEYOR – CITS TRADE			
TRADE TECHNOLOGY			
Duration	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Practical 16 Hrs Theory 06 Hrs	Ensure implementation of safe working practices, environment regulation.	**Safety Practices** 1. Ensure the norms of Safe Surveying Practices. 2. Proper maintenance and general Safety of Tools &Equipment. 3. Give safety first priority in planning each survey. 4. Report and document all occupational injuries and illnesses. 5. Following personal protective equipment should be provided: 6. • Safety Goggles • Dust masks • Gloves • Hearing protection • Chaps • Rainwear • High visibility apparel	**Safety Responsibility** Individual responsibility Personal protective equipment Field and institution responsibility Safe surveying practice.
Practical 16 Hrs Theory 06 Hrs	Resolve the problems occurring in chain survey.	7. Practice in Chain surveying-advanced type problems-locating details, booking, plotting, finishing in ink & colouring.	Related information
Practical 32 Hrs Theory 12 Hrs	Identify the interior details observed by Plane Table survey.	8. Practice in Plane table surveying-running an open traverse with Plane table, fixing details, inking, finishing, colouring and tracing.	Related information
		9. Three point and two-point problems.	Related information
Practical 48 Hrs Theory 18 Hrs	Establish the graphical representation on proposed gradient by leveling and Theodolite survey.	10. Level surveying-differential leveling, reciprocal leveling, fly leveling, longitudinal sectioning, cross sectioning & check levelling. Preparation of sections & working profiles. Setting out gradients.	Dumpy level & Auto level. Various methods of levelling, namely simple leveling, differential leveling, reciprocal leveling, fly leveling, check leveling, longitudinal sectioning, cross sectioning, etc. Plotting of sections & working profiles,

			establishment of gradients.
		11. Practice in Theodolite survey-running a closed & open traverse.	Methods of calculating area of a closed traverse from coordinates.
		12. Finding heights & distances of accessible & inaccessible objects with theodolite and chain and calculating the same-use of Box sextant.	Working out problems on finding out areas of closed traverses, heights & distances-Box sextant-its description & use. Abney's level & its description.
Practical 64 Hrs Theory 24 Hrs	Compute and observe topographic map by contour surveying using different equipment.	13. Contouring by spot level method including interpolation.	Topographic survey and principle-instruments & accessories used in topographic survey-contours & their characteristics.
		14. Contouring by cross section method including interpolation of contours (Grid method). Contour gradient-preparation of sections from contour map-computation of volume by Prismoidal & Trapezoidal formula. Establishment of gradient using Abney level, Ceylon Ghat Tracer and by using boning rod & sight rail.	Contouring-contour intervals-selection of contour interval-characteristics & uses of contours. Vertical intervals, horizontal equivalents-methods of determining contours-comparison of different methods and their application.
		15. Direct contouring using levels for vertical control, plane table & telescopic alidade for horizontal control.	Interpolation of contours by different methods and preparing contour maps-computation of volume-Prismoidal & Trapezoidal formula. Construction & use of boning rods. Establishment of gradient using Ceylon Ghat Tracer, Delisle's Clinometer & Abney level. Preparation of field record for topographic surveys-height book-height tracing and colour trace.
Practical 32 Hrs Theory 12 Hrs	Plan a road project survey.	16. Road Project-reconnaissance, preliminary & final location survey including preparation of route map, traversing, leveling, preparation of sections, computation of earthwork & other materials.	Types of surveys for the location of a road-reconnaissance, preliminary & final location survey. Alignment of roads-embankment & cutting-road gradients-foundation, drainage, camber, super elevation, road surfaces such

			as earth road, water bound macadam & concrete pavements.
Practical 16 Hrs Theory 06 Hrs	Execute tachometric survey.	17. Determination of horizontal & vertical distances by tacheometric method. Enlargement & reduction of plans & maps.	Tacheometry-various methods of tacheometry-determination of horizontal & vertical distances by various methods.
Practical 96 Hrs Theory 36 Hrs	Conduct topographical survey.	18. Conducting topographic survey of undulated area by theodolite triangulation and plane table resection & intersection method using Indian pattern clinometers.	Different methods of finding area of irregular figures-planimeter-its principle, construction, use & precautions. Working out problems of areas by using planimeter. Enlarging & reducing of plans. Use of proportionate compass and pantographs and their uses.
Practical 80 Hrs Theory 30 Hrs	Represent and classify different survey instrument using different methods.	19. Setting out simple curves by chain & tape by different methods-setting out compound curves & transition curves by theodolite-setting out vertical curves.	Problems on simple, compound & vertical curves-types of transition curves & vertical curves.
		20. Reducing & enlarging the plans and maps using pentagraph and proportionate compass. Use of planimeter.	Parts of pantograph& planimeter.
		21. Measuring offsets of obstructed lines, measurement of field in triangle & offset systems, base line system, fixing, missing, land demarcation.	Methods of taking offsets on obstructed lines & offset lines, field measurement in triangle & offset systems. Method of fixing survey maps on boundaries.
		22. Tracing & inking taluk, district and state maps. Observation of substance bar & its calculation.	Convergence of meridian-substance bar & its use. Glossary of terms.
		23. Azimuth observation & calculation. 24. Determination of the meridian and Azimuth.	Computation of latitudes and azimuth.
Practical 64 Hrs Theory	Execute plotting and estimating by	25. Working with CAD. Use of various commands. Adding dimensions and text.	Introduction to computer aided drawing-working with CAD-setting limits-drawing

24 Hrs	2D detailed drawing in customized AutoCAD environment.	Development of 2D drawings. Preparation of drawings and estimates of buildings.	lines-using grid & snap-saving work-drawing shapes-Exit & Quit commands. Editing, adding dimension and text. Editing drawing using various MODIFY commands. Developing building drawings with CAD. Preparation of estimate.
Practical 16 Hrs Theory 06 Hrs	Input conventional signs and symbols as per Survey dimensioning standard.	26. Conventional signs & symbols used in Engineering survey-dimensioning as per IS: 696. Drawing of a residential building.	Introduction to drawing office, introduction to Bureau of Indian standards (BIS) code of practice for general & architectural drawing. Basics of orthographic projection.
Practical 32 Hrs Theory 12 Hrs	Execute Chain survey.	27. Practice in Chain survey. Use of optical square and cross staff (PWD type). Practice on Compass survey-magnetic & true meridian, declination & its variation with local attraction.	Numerical problems on Chain survey & Compass survey.
Practical 16 Hrs Theory 06 Hrs	Adopt the procedure of leveling to determine undulation of earth surface.	28. Practice in leveling and theodolite survey.	
Practical 16 Hrs Theory 06 Hrs	Develop survey concept of roads and railway tracks.	29. Cross section of roads and railway tracks.	Introduction to roads-general principle of alignment-super elevation of roads. Introduction to railways-their gauges.
Practical 16 Hrs Theory 06 Hrs	Ensure set up of digital theodolite for critical measurement.	30. Setting up of Digital theodolite. Measurement of horizontal & vertical angles. Traversing using Digital theodolite.	Modern Survey Instruments-Digital Theodolite-measurement of angles by various methods-Traversing using Digital theodolite (open & closed).
Practical 48 Hrs Theory 18 Hrs	Determine measuring features for survey using Total Station and GPS.	31. Measurements of angles and coordinates-determination of height-determination of area using Total Station. Traversing (open & closed) using total station. Determination of the coordinates of the points using GPS.	Total Station-Measurements of angles & coordinates-setting out of angles & lines. Traverse survey of closed & open fields-determination of enclosed area using total station. Uses of GPS-determination of coordinates.

			Photogrammetry-terrestrial & aerial photogrammetry.
Practical 32 Hrs Theory 12 Hrs	Construct map on AutoCAD workspace.	32. More practice on Auto CAD. Practice on Map & Land survey software.	CAD software commands & use of different menus. Commands & menus of Map & Land survey software.

SYLLABUS FOR CORE SKILLS
1. Workshop Calculation & Workshop Science (120Hrs + 80 Hrs)
2. Training Methodology (TM) (Common for all CITS trades) (320 Hrs + 200 Hrs.)

Learning outcomes, assessment criteria, syllabus and Tool List of above Core Skills subjects which is common for a group of trades, provided separately in www.bharatskills.gov.in

7. ASSESSMENT CRITERIA

LEARNING OUTCOME	ASSESSMENT CRITERIA
TRADE TECHNOLOGY (TT)	
1. Ensure implementation of safe working practices, environment regulation.	Identify basic life support training to perform DRSABCD.
	Check skill of survey report accuracy.
	Avoid waste, ascertain unused materials and components for disposal, store these in an environmentally appropriate manner.
	Select proper instrument and adjust error correction.
	Identify tools & instruments and equipment for makeup and other equipment.
	Assess field survey work.
	Observe safety procedure as per standard norms.
	Measure all dimensions in accordance with standard specification.
2. Resolve the problems occurring in chain survey.	Resolve the problems by →Correction for Standardization →Correction for Slope →Correction for Temperature →Correction for Pull or Tension →Correction for Sag
	Observe area to fix the base position of survey lines and survey position.
	Ensure reconnaissance, selection of station, measurement of lines and taking offsets of different objects in the field.
	Prepare an index sketch of the area showing the possible stations and from there the arrangement of different lines.
	Check every station should be located with respect to three permanent objects.
	Ensure the chain is properly stretched so that no sag in it.
	Check offsets are taken on the both sides of the survey lines and recorded in the field book.
	Maintained accuracy in Tie and check lines measurement and offsets taken.
	Choose suitable scale to plot drawing.
	Ensure offsets like building, trees, electric posts etc.
	Prepare maps by plotting data.
3. Identify the interior details observed by Plane Table survey.	Set up a Plane Table over a station.
	Perform the method to locate objects from a single station.
	Perform the method to locate inaccessible points.
	Perform the method for connecting the traverse station.
	Ascertain the Plane Table orientation by magnetic needle and back sighting.
	Establish a new station for plotting the missing object.

	Ensure the precautions to be taken in plane table surveying.
	Solve the problem if all the station pegs are removed and if any important point is not plotted.
	Plot interior details like trees, buildings, lamp posts using Plane Table surveying.
4. Establish the graphical representation on proposed gradient by leveling and Theodolite survey.	Identify the adjustment of a theodolite.
	Observe the process of measuring horizontal angles, vertical angles and deflection angles.
	Identify the methods of traversing by theodolite.
	Determine the height of an inaccessible tower.
	Create the data sheet showing the reduced levels of points measured.
	Establish the graph showing the vertical ground profile of area investigated.
5. Compute and observe topographic map by contour surveying using different equipment.	Establish the inter-visibility of different points.
	Plan a suitable route for a given gradient marked on the map.
	Compose a section of the ground surface in any direction from the topographic map.
	Estimate the quantities of earth work.
	Predict the characteristic features of contour lines of pond, hill, ridge, valley and vertical cliff.
	Formulate the reduced levels of each point by any methods.
	Draw contour lines of 0.1 m interval
	Draw the contour map using EXCEL.
6. Plan a road project survey.	Understand the scope of work.
	Review the existing study reports, standards and specifications.
	Engineering investigations.
	Detailed engineering survey of alignment.
	Preparation of topographical map.
	Study cross-drainage works and propose suitable structure.
	Preparation of working drawing
	Preparation of quantity and cost estimate.
	Preparation of survey and design report.
7. Execute tachometric survey.	Ensure indirect measurement of horizontal or inclined distances by Tachometric theodolite.
	Determine the Tachometric constant.
	Perform direct reading by Auto-reduction Tachometer.
	Prepare a Tachometric Field Book.
8. Conduct topographical survey.	Understand the scope of work
	Obtain the relevant survey data/maps for the area mentioned.
	Ensure the boundary confirmation
	Pick x,y,z position of all manmade and natural ground features.
	Point out ground positions and levels of sewer lines, drains, spot heights.

	Involve plotting of details picked on site to produce the survey plan / map.
	Provide the survey data in an CAD format.
9. Represent and classify different survey instrument using different methods.	Employ the method by Chain and Tape for horizontal curve setting.
	Ensure distances, perpendicular offsets and the super-elevation by the method of Perpendicular Offset from tangents.
	Set the theodolite along the back tangent and compare the deflection angles by Rankine's Method.
	Set out circular curve using data from two intersecting straight portion of different roads.
	Observe the instrument stations in the same vertical plane as the elevated object by theodolite.
	Achieve the reduction or enlargement of plans using Pantograph.
	Ensure the computation of area from a plotted map by planimeter.
	Compile plotting data to prepare maps observed by triangle and offset system and base line system.
	Observe geographic azimuth in field magnetic survey.
10. Execute plotting and estimating by 2D detailed drawing in customized AutoCAD environment.	Ensure application of advance CAD commands e.g. layers, block, insert, group, divide, measure, design center, text gradient, dimension style, leader, layouts, model space, view ports.
	Generate line segment in AutoCAD importing data from Excel worksheet.
	Manipulate annotation, dimension, text position and insertion of table.
	Manage the location of the drawing files to be saved.
	Construct a site Plan of the Residential Building.
	Create sectional view of a road, culvert.
	Generate a simple survey drawing in AutoCAD.
11. Input conventional signs and symbols as per Survey dimensioning standard.	Incorporate a typical index sketch / site plan with the standard symbols of necessary objects.
	Visualise the drawing of typical cross –section of railway tracks, embankment, layout plans of railway platforms.
	Plan for preparing drawing of a masonry culvert.
	Check layout of field channels, open & underground.
12. Execute Chain survey.	Execute field work: reconnaissance, selection of station, measurement of lines and taking offsets of different objects in the field.
	Ensure correct methods to keep records in the field book.
	Input rough sketches and symbols of different stations.
	Ensure the suitable scale and maintain accuracy for plotting data to prepare maps.
13. Adopt the procedure of levelling to	Planto determine the reduced level of different points on the ground.
	Ensure the suitable placement of the instrument..

determine undulation of earth surface.	Observe the procedure of adjustment: setting up, levelling up and elimination of parallax.
	Consider the station A as Bench Mark on average elevation.
	Observe the staff reading and change point reading both back and fore.
	Formulate the reduced levels of the points by – Line of Collimation method and Rise and Fall method.
	Represent a graph showing the vertical ground profile of area investigated.
14. Develop survey concept of roads and railway tracks.	Confirm the starting point of the project marked by a constructing pillar.
	Originate the levelling to connect nearby GTS benchmark.
	Conduct a prismatic compass survey to prepare a route map.
	Record the magnetic bearings of the lines of traverse along the alignment.
	Perform the cross-sectional levelling at regular intervals.
	Observe the cross-section details of river crossing.
	Undertake the soil survey along the alignment.
	Construct a route survey map.
15. Ensure set up of digital theodolite for critical measurement.	Ensure the setting of digital theodolite exactly over the station mark or on the station peg.
	Imply the levelling instrument with the legs of the tripod by bringing the small circular bubble provided on the tribranch in the centre..
	Achieve focussing the eyepiece and the objective.
	Ensure the reading of vertical angle measurement.
	Observe the measurement of deflection angle magnetic bearing.
	Compute latitude and departure distances.
	Manipulate the sources of errors in digital theodolite.
16. Determine measuring features for survey using Total Station and GPS.	Ensure the Electronic distance measuring (EDM) instrument as a part of Total Station.
	Incorporate the electronic theodolite to measure vertical and horizontal angle.
	Observe the data processing made by the in-built microprocessor.
	Observe the corrections for temperature and pressure are automatically made in Total Station.
	Communicate the information stored in the electronic handbook to computers.
17. Construct map on AutoCAD workspace.	Incorporate and plot the interior details of the area surveyed in a drawing sheet by AutoCAD.
	Formulate the area of the plot.
	Develop map and plot contour and cross sections..

8. INFRASTRUCTURE

LIST OF TOOLS AND EQUIPMENT FOR SURVEYOR - CITS			
S No.	**Name of the Tool & Equipment**	**Specification**	**Quantity (Nos.)**
A. Trainee's Tool kit			
1.	Engineering Instrument Box		26
2.	Protractor full circular	15 cm	26
3.	Card board/ plastic metric scale	set- A to H	26
4.	Celluloid set square	45˚ & 60˚	26
5.	Drawing board	1250 x 900 mm	26
6.	T square	1250 mm/ Mini drafter	26
7.	Erasing shield small size		13
8.	Architect's & builder's template		13
9.	Drawing machine (Horizontal type)		26
10.	French curve	set of 12	26
11.	Flexible curve	80 cm long	26
12.	Metallic tape	15 m	26
13.	Scientific calculator pocket size		26
B. General Outfit			
14.	Planimeter sliding bar pattern	70 cm with magnifier-metric	2 (One digital)
15.	Pentograph-brass with accessories	60 cm	1
16.	Tracing table with plate glass	1250 x 900mm	1
17.	Computer-latest version	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	5
18.	UPS		As required
19.	Computer with latest configuration with printer	CPU: 32/64 Bit i3/i5/i7 or latest processor, Speed: 3 GHz or Higher. RAM:-4 GB DDR-III or Higher, Wi-Fi Enabled. Network Card: Integrated Gigabit Ethernet, with USB Mouse, USB Keyboard and Monitor (Min. 17 Inch. Licensed Operating System and Antivirus compatible with trade related software.	1 set

20.	Computer table		6
21.	Computer chair-revolving type		26
22.	DLP Projector	2000 lumen or higher	1
23.	White board	6' x4'	1
24.	Almirah	1800 x 1200 x 450mm	3
25.	Chest of drawers	8 drawers	2
26.	Draughtsman table		26
27.	Draughtsman stool-revolving type		26
28.	Executive table	6' x 6'	1
29.	Revolving chair with arm		1
30.	Trainees' lockers		4
31.	Book shelf		2
32.	Wooden geometry box for chalk board		2
33.	First Aid kit		1
34.	Hub/Switch/Access point		1
35.	LAN & internet connectivity		As required
36.	A3 Printer-colour		1
37.	Q-PRO/Built Master software for estimation		1
38.	CAD software	for 5 users-latest version	1
39.	Map & Land Survey software		1 each
C. Surveyor Instruments			
40.	Land measuring chain	30 m	5
41.	Metallic tape	30 m	4
42.	Steel tape	20 m	2
43.	Ranging rod	3 m	25
44.	Optical square PWD pattern		5
45.	Optical square-box type, circular		5
46.	Dumpy level-complete set		5
47.	Auto level		4
48.	Digital level along with bar coded staff		5
49.	Leveling staff-telescopic type		5
50.	Plane table with stand		5
51.	Alidade		5
52.	Telescopic alidade		2
53.	Trough compass		5
54.	'U' frame with plumb bob		5
55.	Theodolite with stand		4
56.	Electronic theodolite with Moonlight LCD display with tripod		1
57.	Total station-latest version		1
58.	GPS-latest version with base & rover communication options		2
Consumable items			
59.	Drawing sheet-	A1 & A2 size	As required
60.	Tracing paper roll		As required
61.	Drawing pencil-	HB, 2H, etc.	As required
62.	Eraser		As required

63.	Adhesive tape		As required
64.	Drawing pen/ Rotring pen		As required
65.	Drawing ink		As required
66.	Color pencil		As required
67.	Ammonia paper roll		As required
68.	Ammonia liquid		As required
69.	Machine made drawing paper		As required
70.	Xerox paper	A4 size	As required
71.	CAD Software		As required

ANNEXURE - I

The DGT sincerely acknowledges contributions of the Industries, State Directorates, Trade Experts, Domain Experts and all others who contributed in revising the curriculum. Special acknowledgement is extended by DGT to the expert members who had contributed immensely in this curriculum.

List of Expert members participated for finalizing the course curriculum of Surveyor (CITS) trade held on at CSTARI, Kolkata.			
S No.	**Name & Designation Sh/Mr/Ms**	**Organization**	**Remarks**
1.	Prof. Nirjhar Dhang. (H.O.D)	Dept. of Civil Engg. IIT Kharagpur	Chairman
2.	Col. N. B. Saxena.	Construction Skill Development Council of India (CSDCI)	Member
3.	Satish Gottipati. (M. D.)	Preca Solutions (E)	Member
4.	Meena Raghunathan. (Director, Community Science.)	GMRU Foundation, Hyderabad.	Member
5.	D. K. Chattopadhayay. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
6.	S. R. Vhatkar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
7.	A. K. Naskar. (Training Officer.)	ATI, Kolkata. Dasnagar, Howrah.	Member
8.	S. Chockalingam. (Training Officer.)	CTI, Chennai,	Member
9.	Tapan Kr. Halder. (Training Officer.)	RDAT, Kanpur.	Member
10.	Arpana Singh. (T.O.)	N.V.T.I (W) Noida.	Member
11.	P. Karithashankar. (T. O.)	N.V.T.I (W) Noida.	Member
12.	Simni. (T. O.)	N.V.T.I (W) Noida.	Member
13.	Suman Kumari. (T. O.)	N.V.T.I (W) Noida.	Member
14.	M.C Sharma	DGE&T (HQ)	Mentor


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