GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP
DIRECTORATE GENERAL OF TRAINING

COMPETENCY BASED CURRICULUM

MINE SURVEYOR

(Duration: Two Years)

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL- 4

SECTOR – CONSTRUCTION

Directorate General of Training

Skill India
कौशल भारत - कुशल भारत

MINE SURVEYOR

(Engineering Trade)

(Designed in 2022)

Version: 1.0

CRAFTSMEN TRAINING SCHEME (CTS)

(Flexi MoU)

NSQF LEVEL - 4

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training
CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE
EN-81, Sector-V, Salt Lake City,
Kolkata – 700 091
www.cstaricalcutta.gov.in

CONTENTS

1. COURSE INFORMATION

During the two-years' duration a candidate is trained on subjects viz. Professional Skill, Professional Knowledge and Employability skills. In addition to this a candidate is entrusted to make/do project work and Extra Curricular Activities to build up confidence. The practical skills are imparted in simple to complex manner & simultaneously Professional Knowledge (theory subject) is taught in the same fashion to apply cognitive knowledge while executing task. The practical part starts with simple geometrical drawing and finally ends with preparing topographical map, Cadastral/ mouza map, detailed road project, survey drawing using CAD, application of GIS techniques, Hydrographic survey, Transmission line site survey, railway line site survey, sanction plan of Residential / Public building, and detailed estimate. The semester wise course coverage is categorized as below:-

FIRST YEAR: In the beginning of the course the trainees are acquainted with occupational safety & health, PPE, etc. The practical part starts with basic drawing (consisting of lettering, numbering, geometrical figure, symbols & representations). Later the drawing skills imparted are drawing of different scales, projections, perform site survey and prepare a site plan using chain / tape, prismatic compass, perform AutoCAD drawing. Observation of all safety aspects is mandatory. The safety aspect covers components like OSH&E, PPE, Fire extinguisher, First Aid, etc. Knowledge and application of Computer Aided Drawing has been introduced in this semester. Workspace creating drawing using toolbars, commands, and menus. Plotting drawing from CAD.

In this semester different site survey using Plane table(radiation, intersection, traversing, determination of height), Theodolite (measurement of angle, traversing, computation of area), Levelling instrument (different levelling – differential, reciprocal, etc.), tachometer (determination of horizontal and vertical distance, constants, etc.), field book entry, plotting, mapping, calculation of area, preparing traverse drawing, simple building drawing using CAD are being taught in the practical.

SECOND YEAR: Making topographical map using Level instruments with contours (Interpolation of contour, preparation of section, computation of volume, setting of simple, compound, reverse, transition and vertical curve), performing survey using Total Station and preparation of map (measurement of angle, co-ordinates and heights, downloading survey data and plotting), making of site plan by Cadastral survey (preparation of site plan, calculation of plot area, etc.), performing road project survey (location survey and preparation of route map, profile/ longitudinal / cross sectional levelling and plotting) and survey drawing using CAD.

Drawing of cartographic projection, setting and application of GIS & GPS techniques in various fields, collection and processing of data, performing hydrographic survey (determining hydrographic depth, measuring velocity of flow, determining cross sectional area of river, calculating the discharge of a river, etc.), performing transmission line site survey (making of alignment, conducting detailed survey, final location survey and making of tower foundation pit point), performing railway line site survey, drawing of building by CAD and preparation of estimation are being done as part of practical training.

2. TRAINING SYSTEM

2.1 GENERAL

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of the Labour market. The vocational training programmes are running under aegis of Directorate General of Training (DGT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes under DGT for propagating vocational training.

K.K. Techno Solution Pvt. Ltd. shall conduct courses pan-India locations leveraging the facilities and services available at ITIs, regional training centers, training centers of training partners, vendors and dealers associated with K.K. Techno. They will ensure that not less than 50% of trainees are placed with K.K. Techno or its business partners for not less than Two years duration. It will also ensure the eligible trainees take up Apprenticeship / higher education in suitable streams and shall also guide the students to become Entrepreneurs. K.K. Techno Solution Pvt. Ltd. will strictly follow the policy guidelines for Flexi - MoU as in place from time to time. No deviation for the same would be permitted. Every Alternate Month Admission and Exam for trades run under Flexi MoU at training locations of K.K. Techno. Theory content to be 30% and practical content to be 70%.

Broadly candidates need to demonstrate that they are able to:

- Read & interpret technical parameters/documentation, plan and organize work processes, identify necessary materials and tools.
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional knowledge, core skills & employability skills while performing the job and maintenance work.
- Check the task/job for functioning, identify and rectify errors in task/job.
- Document the technical parameters related to the task undertaken.

2.2 PROGRESSION PATHWAYS

- Can take admission in diploma course in notified branches of Engineering by lateral entry.
- Can join Apprenticeship programme in different types of industries leading to National Apprenticeship certificate (NAC).
- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.

2.3 COURSE STRUCTURE

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

S No.	Course Element	Notional Training Hours	
		1st yr.	2nd yr.
1	Professional Skill (Trade Practical)	1620	1620
2	Professional Knowledge (Trade Theory)	450	450
3	Employability Skills	120	60
	Total	**4320**	

2.4 ASSESSMENT & CERTIFICATION

I. Conducting training of selected candidates is the sole responsibility ofIndustrial Training Partner (ITP).

II. Assessment will be jointly done by ITP and DGT. Practical and formative assessment shall be conducted by ITP, and Computer Based theoretical exams shall be conducted by DGT.

III. ITP must refer to the latest examination reform guidelines issued by DGT dated 4thOctober 2018 any changes or revisions to the same shall be applicable to flexi-MoU scheme.

IV. Maximum attempts for clearing the exam and obtaining NTC shall be in line with CTS.

V. For practical examination and formative assessment, ITP has been given flexibility to design the questions, assess the candidates and upload their marks in the scheme portal.

VI. ITP shall develop a comprehensive Question Bank (in English and Hindi) of minimum 1000 questions, grouped by chapters and difficulty level. The same shall be vetted by NIMI experts and then be handed over to DGT for conducting theory exams. DGT may add some questions to the same before conducting actual exams.

VII. Theoretical exams shall be conducted by DGT in Computer Based Test format. Upon completion of course and payment of requisite examination fee by ITP, admit cards shall be generated by scheme portal.

VIII. DGT shall arrange for conduct of computer based theory exam at designated examination centres & certify the successful trainees with e-NTC under flexi-MoU scheme with mention of ITP name in the Certificate.

IX. Students, who have successfully appeared in the final exam after completion of course, are eligible to register as apprentices.

The trainee will be tested for his skill, knowledge and attitude during the period of the course and at the end of the training program as notified by the Government of India (GoI) from time to time. The employability skills will be tested in the first year itself.

The **Internal Assessment** during the period of training will be done by **Formative Assessment Method** by testing for assessment criteria listed against learning outcomes. The training institute has to maintain an individual trainee portfolio as detailed in assessment guideline. The marks of internal assessment will be as per the template (Annexure –II).

The learning outcome and assessment criteria will be the basis for setting question papers for final assessment. The 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 REGULATION

The minimum pass percentage for practical is 60% & minimum pass percentage of theory subjects is 33%.

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. Due consideration should 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 the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences and records of internal (Formative) assessments are to be preserved until forthcoming examination for audit and verification by examination 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 produce work which demonstrates attainment of an acceptable standard of craftsmanship with occasional guidance, and due regard for safety procedures and practices	• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment. • 60-70% accuracy achieved while undertaking different work with those demanded by the component/job. • A fairly good level of neatness and consistency in the finish. • Occasional support in completing the project/job.
(b) Weightage in the range of 75%-90% to be allotted during assessment	
For this grade, a candidate should produce work which demonstrates attainment of a reasonable standard of craftsmanship, with little guidance, and regard for safety procedures and practices	• Good skill levels in the use of hand tools, machine tools and workshop equipment. • 70-80% accuracy achieved while undertaking different work with those demanded by the component/job. • A good level of neatness and consistency in the finish. • Little support in completing the project/job.
(c) Weightage in the range of more than 90% to be allotted during assessment	
For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship.	• High skill levels in the use of hand tools, machine tools and workshop equipment. • Above 80% accuracy achieved while undertaking different work with those demanded by the component/job. • A high level of neatness and consistency in the finish. • Minimal or no support in completing the project.

3. JOB ROLE

Surveyor, Mine surveys mines and prepares maps indicating location, topographical and underground features describing outline, results of deposits, natural or other barriers, linking space for passages and seams, crevices for driving shafts for mechanical quarrying, etc. for open pit and underground mines. Performs function of Surveyor, Topographical and directs Topo-Auxiliaries or helpers in location of points and in placing of instruments, theodolites, compasses, etc. Works as Topo-Traverser for connecting points by metered chains and takes measurements. Records size, location, elevation, angles, and plots data on drawing-paper marking boundaries, showing exact location of roads structures, natural or artificial barriers, surface and underground mineral, bringing out topographical features. May specialize in survey of coalmines, metal mines or quarries.

Reference NCO-2015:

a) 2165.0500 – Surveyor, Mine

4. GENERAL INFORMATION

Name of the Trade	**Mine Surveyor (Flexi MoU)**
NCO - 2015	2165.0500
NSQF Level	Level-4
Duration of Craftsmen Training	Two years
Entry Qualification	Passed 10thClass examination
Minimum Age	16 years as on first day of academic session.
Unit Strength (No. Of Student)	20
Space Norms	64 Sq. m.
Power Norms	3 KW
Instructors Qualification for	
1. Mine Surveyor Trade	Degree in Survey Engineering / Civil Engineering from recognized university with one year experience in relevant field. **OR** Diploma in Survey Engineering /Civil Engineering from recognized board of education with two years experience in relevant field. **OR** NTC/NAC in the Trade of "Mine Surveyor" With 3 years post qualification experience in the relevant field. **Desirable: -** Preference will be given to a candidate with CIC (Craft Instructor Certificate) in Mine Surveyor trade. ***Out of two Instructors required for the unit of 2(1+1), one must have Degree/Diploma and other must have NTC/NAC qualifications.***
2. Employability Skill	MBA/ BBA / Any Graduate/ Diploma in any discipline with Two years' experience **w**ith **short term ToT Course in** Employability Skills from DGT institutes. (Must have studied English/ Communication Skills and Basic Computer at 12th / Diploma level and above) **OR**

	Existing Social Studies Instructors in ITIs with short term ToT Course in Employability Skills from DGT institutes.
5. Minimum Age for Instructor	21 Years
List of Tools and Equipment	As per Annexure – I

5. NSQF LEVEL COMPLIANCE

NSQF level for **Mine Surveyor** trade CTS (Flexi MoU): **Level-4.**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

a. Process
b. Professional Knowledge
c. Professional Skill
d. Core Skill
e. Responsibility

The broad learning outcome of **Mine Surveyor** trade under CTS (Flexi MoU) mostly matches with the Level descriptor at Level- 4.

The NSQF Level-5 descriptor is given below:

Level	Process Required	Professional Knowledge	Professional Skill	Core Skill	Responsibility
Level 4	Work in familiar, predictable, routine, situation of clear choice.	Factual knowledge of field of knowledge or study.	Recall and demonstrate practical skill, routine and repetitive in narrow range of application, using appropriate rule and tool, using quality concepts.	Language to communicate written or oral, with required clarity, skill to basic Arithmetic and algebraic principles, basic understanding of social political and natural environment.	Responsibility for own work and learning.

6. LEARNING OUTCOME

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

6.1 GENERIC LEARNING OUTCOMES (Employability Skills)

1. Introduction to Employability Skills
2. Constitutional values - Citizenship
3. Becoming a Professional in the 21st Century
4. Basic English Skills
5. Career Development & Goal Setting
6. Communication Skills
7. Diversity & Inclusion
8. Financial and Legal Literacy
9. Essential Digital Skills
10. Entrepreneurship
11. Customer Service
12. Getting Ready for Apprenticeship & Jobs

6.2 SPECIFIC LEARNING OUTCOMES

FIRST YEAR

1. Recognize & comply safe working practices, environment regulation. Concept of drawing & sheet layout.
2. Draw lettering & numbering & dimensioning applying drawing instruments.
3. Draw plain geometrical figures, curves & conics.
4. Construct plain scale, diagonal scale, comparative scale, vernier scale.
5. Draw orthographic projections of different objects with proper dimensioning & lettering.
6. Execute basic operation of Mine Surveyor and Draw conventional signs & symbols used in surveying.
7. Perform site survey using chain/ tape & prepare a site plan.
8. Perform the site survey using Dial and set up a compass & check its accuracy-taking bearings.
9. Perform the site survey using prismatic compass.
10. Perform different types of levelling activities at site.
11. Perform traverse survey by Theodolite, prepare a site map.
12. Perform the site survey using the plane table.
13. Perform Theodolite survey.
14. Read and apply engineering drawing for different application in the field of work.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

SECOND YEAR

16. Perform curve survey.
17. Perform Correlation survey.
18. Perform Shaft and drift survey.
19. Perform Stope survey.
20. Perform Tacheometric survey.
21. Measure area and volume using of digital theodolite and determine area by planimeter.
22. Prepare Mine plans and sections.
23. Perform survey by using Total Station and prepare the site map.
24. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.

7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA

SPECIFIC LEARNING OUTCOME	
LEARNING OUTCOME	**ASSESSMENT CRITERIA**
FIRST YEAR	
1. Recognize & comply safe working practices, environment regulation. Concept of drawing & sheet layout.	10.1 Ensuring data & information received are sufficient for preparation of drawing.
	10.2 Preparing layout of drawing sheet
	10.3 Preparing a title box
	10.4 Setting up & fixing drawing paper on the drawing board
2. Draw lettering & numbering applying drawing instruments.	11.1 Drawing horizontal line, vertical line, parallel line using T-square, set- square
	11.2 Drawing different types of lettering
	11.3 Drawing numbers in different fonts
	11.4 Drawing different types of lines
	11.5 Dimensioning a drawing. (various types)
3. Draw plain geometrical figures, curves & conics.	12.1 Drawing geometrical figures from given data (different types)
	12.2 Constructing ellipse and parabolic curves using the various conditions given.
4. Construct plain scale, diagonal scale, comparative scale, vernier scale.	13.1 Drawing different types of scales.
	13.2 Finding out R.F of the scale, calculate the length of the scale on drawing
	13.3 Checking the drawing to confirm their correctness
5. Draw orthographic projections of different objects with proper dimensioning & lettering.	14.1 Developing view in orthographic projection by placing object between horizontal & vertical plane of axis.
	14.2 Generating side view of blocks in different inclination on V.P & H.P by auxiliary vertical plane.
	14.3 Constructing an isometric scale to a given length.
	14.4 Drawing the isometric projection of regular solids.
6. Execute basic operation of Mine Surveyor and Draw conventional signs & symbols used in surveying.	15.1 Explaining objects, principles & application of Mine Surveyor.
	15.2 Reading Mine Maps, contours & drainage Maps.
	15.3 Drawing some conventional signs & symbols used in topographic maps of underground and surface mines.

7. Perform site survey using chain/ tape & prepare a site plan.	16.1 Performing surveying measuring distance by chain/ tape and other accessories
	16.2 Determining Errors in chaining and their corrections.
	16.3 Entering measured data in field book and plotting the same.
	16.4 Conducting chain surveying and prepare a site plan.
	16.5 Calculating area of a plot.
8. Perform the site survey using Dial and set up a compass & check its accuracy-taking bearings.	17.1 Set up a compass.
	17.2 Check its accuracy-taking bearings & Calculate angles.
	17.3 Determine the bearings of a given line.
	17.4 Establish lines of given bearings.
	17.5 Conduct closed traverse of built up fields / plotting the same.
	17.6 Surveying of a tank/ a route / obstructed field by chain traverse.
	17.7 Apply method of finding height of inaccessible objects.
9. Perform the site survey using prismatic compass.	18.1 Measure bearings of a line and conduct the traverse survey using prismatic compass & others accessories.
	18.2 Make Entry in field book and Compute the correct bearings of the plot.
	18.3 Plot the traverse & adjust the closing error.
	18.4 Calculate the area of the traverse.
10. Perform different types of levelling activities at site.	19.1 Setting up a level & performing temporary adjustments
	19.2 Making permanent adjustment of dumpy level& auto levels.
	19.3 Performing simple levelling differential levelling, reciprocal levelling ,fly levelling , longitudinal sectioning, cross sectioning and check levelling, Reduction of levels
	19.4 Preparing sections and working profiles; Setting out gradients.
11. Perform traverse survey by Theodolite, prepare a site map.	20.1 Locating contour lines by direct and indirect methods
	20.2 Preparing of sections from contour map; computation of volume by prismoidal formula, trapezoidal formula.
	20.3 Establishing gradient using abney level, Ceylon ghat tracer and by using boning rod and sight rail.
	20.4 Plotting of contour maps. Uses of contour map.

12. Perform the site survey using the plane table.	21.1 Setting up of plane table, leveling, centering& orientation. Surveying an area with plane table by radiation & intersection methods
	21.2 Traversing with plane table of built up areas, running an open traverse with plane table & fixing details
	21.3 Finding the position of table by three point & two point problems. Use of tangent &Disle's clinometers-Abney level and telescopic alidade for finding heights of surrounding points.
13. Perform Theodolite survey.	22.1 Setting up the theodolite and booking the verniers readings. Performing the permanent adjustments of theodolite
	22.2 Measuring horizontal, vertical & deflection angles, setting out angles, prolongation of lines by various methods.
	22.3 Traversing (closed and open) using theodolite and steel tape measuring horizontal angles, bearings of lines. Plotting of traverse by co-ordinates, computation of area using coordinates (error adjustments).
14. Read and apply engineering drawing for different application in the field of work.	Read & interpret the information on drawings and apply in executing practical work.
	Read & analyze the specification to ascertain the material requirement, tools and assembly/maintenance parameters.
	Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work.
15. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	Solve different mathematical problems
SECOND YEAR	
16. Perform curve survey.	23.1 Drawing and marking the parts of simple circular curve.
	23.2 Setting out a simple circular curve by linear method from given data
	23.3 Setting out a simple circular curve by instrument method from given data

	23.4 Setting out a simple compound curve by instrument method from given data
	23.5 Setting out a simple reverse curve by instrument method from given data
	23.6 Setting out a simple transition curve from given data
17. Perform Correlation survey.	24.1 Marking Underground stations by:- Direct traversing through incline.
	24.2 Plumbing wires in shaft.
	24.3 Co-planning method.
	24.4 Weisbach triangle method.
	24.5 Gyro- theodolite method.
18. Perform Shaft and drift survey.	25.1 Transferring levels underground.
	25.2 Measuring depth of vertical shaft.
	25.3 Marking center& grade line of drift.
	25.4 Marking Highest flood level.
	25.5 Connecting mine plan to national Grid.
19. Perform Stope survey.	26.1 Stope surveying in flat deposit by: Tape triangulation/Tie Method/ Instrumental method.
	26.2 Preparing a cross section levelling and plotting.
	26.3 Stope survey in steeply inclined deposit.
	26.4 Stope survey in massive ore bodies, irregular in dip & shape.
	26.5 Calculating the earth work volume.
20. Perform tachometric survey.	27.1 Determining the stadia constant of a tachometer.
	27.2 Determining horizontal distance by stadia tachometer.
	27.3 Determining vertical distance by stadia tachometer.
	27.4 Enlarging/reducing plans and maps using:-Pentagraph, Proportionate compass.
21. Measure area and volume using of digital theodolite and determine area by planimeter.	28.1 Setting up of digital theodolite.
	28.2 Measuring horizontal and vertical angles traversing using Digital Theodolite.
	28.3 Determining area by Planimeter.
	28.4 Measuring displacement, slope and subsurface movement, and frequency of subsidence.
	29.1 Explaining types of mine plans.

22. Prepare Mine plans and sections.	29.2 Preparing mine plans.
	29.3 Preparing mine plans for abandonment & discontinuance.
23. Perform survey by using Total Station and prepare the site map.	30.1 Explaining Principles, applications of Global Positioning System in Opencast mine surveyor.
	30.2 Explaining Advantages and Disadvantages of GPS in Opencast mine surveyor.
	30.3 Performing adjustments of Total Station.
	30.4 Measuring angles, co-ordinates
	30.5 Determining height.
	30.6 Determining area Traversing (open and closed) using total station
	30.7 Determining the co-ordinates of points using GPS.
24. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	Solve different mathematical problems
	Explain concept of basic science related to the field of study

8. SYLLABUS

SYLLABUS – MINE SURVEYOR			
FIRST YEAR			
Hours.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 80 hrs Professional Knowledge 16 hrs	Recognize & comply safe working practices, environment regulation. Concept of drawing & sheet layout.	1. Importance of trade training, Demonstrate of tools & equipment used in the trade. 2. Occupational safety & Health 3. Introduction of safety and fire fighting equipments and their uses. 4. Introduction of first aid, health, safety & environmental guidelines, legislations & regulations as applicable. 5. Personal Protective Equipment (PPE). 6. Hazard identification and avoidance, Safety signs for Danger. 7. Use of drawing instruments and equipments with care. 8. Method of fixing of drawing sheet on drawing board. 9. Layout of different size of drawing sheet and folding of sheets.	Importance of safety and general precautions related to the trade. All necessary guidance to be provided to the new comers to become familiar with the working of ITI system. Importance of survey or trade Job after completion of training. Introduction of First aid. Job responsibility of the trade. 1. Overview the subject to be taught. 2. List of the instrument equipments to be used during training 3. Layout of drawing sheet 4. Dimensions of drawing sheet.
Professional Skill 80 hrs Professional Knowledge 16 hrs	Draw lettering & numbering & dimensioning applying drawing instruments.	10. Lettering & numbering (Single & double stroke). 11. Types of lines and dimensioning.	Details layout of lettering, lines & dimensioning system.
Professional Skill 80 hrs	Draw plain geometrical figures, curves & conics	12. Construction of plain geometrical figures, curves & conics.	Introduction of surveying, types of surveying, use, application principal.

Professional Knowledge 16 hrs			
Professional Skill 80 hrs Professional Knowledge 16 hrs	Construct plain scale, diagonal scale, comparative scale, vernier scale.	13. Drawing of : - 14. Construction of scales – plain, diagonal, vernier.	Knowledge of different types of scales, determine of R.F & uses of scales.
Professional Skill 80 hrs Professional Knowledge 24 hrs	Draw orthographic projections of different objects with proper dimensioning & lettering.	15. Drawing of three views in orthographic projection of point, line, plane, solid objects. 16. Section of solids. 17. Isometric projection of geometrical solids.	Different types of projection views orthographic, sectional , isometric view.
Professional Skill 160 hrs Professional Knowledge 40 hrs	Basic understanding of Mine Surveyor. Draw conventional signs & symbols used in surveying	Introduction to Mine Surveyor 18. Nature of job done by surveyors in mines. Instruments &equipments used in the trade. 19. Conventional signs & symbols used insurvey. 20. Topography of underground and surface mines. 21. Map reading practice, contours, drainage.	Definition of surveying, objects of surveying and its application in mines, Plane and Geodetic surveying. Classification & Basic principles of surveying.
Professional Skill 125 hrs Professional Knowledge 32 hrs	Perform site survey using chain/ tape & prepare a site plan.	22. Chain and tape survey 23. Chain survey-Practice in unfolding & folding chain, errors & adjustments of chains, alignment, chaining lines, measurement of distances and booking. 24. Practice in chaining, taking offset, use of optical square and cross staff. 25. Setting outright angles and booking. 26. Testing of chain, tape, optical square & cross staff. 27. Procedure in conducting chain survey.	Principle of chain surveying. Equipments in chain surveying, cross staff, optical square its principle and use. Different operations in chain surveying, Ranging: direct & reciprocal ranging. Line ranger structure, principle of working and its use. Chaining: Chaining on flat & slopping ground in mining area and roads, obstacle in chaining. Errors and Offsetting.

		28. Chain survey of small plots by triangulation, booking & plotting. 29. Chain survey of built up plots, locating details, booking & plotting.	
Professional Skill 100 hrs Professional Knowledge 24 hrs	Perform the site survey using Dial. Perform setting up a compass &checkingits accuracy-taking bearings.	30. Dial survey 31. Practice in setting up a compass & checking its accuracy-taking bearings & calculating angles. 32. Determining the bearings of a given lineand establishing lines of given bearings, laying out rectilinear & polygonal plots mining areas using compass & tape. 33. Conducting closed traverse of built up fields and plotting the same. 34. Surveying of a tank, a route or obstructed field by chain traverse, method of finding height of inaccessible objects.	The Prismatic & Surveyors compass, their Comparison. Miners dial, construction and use, Bearing of a line: Definitions: True & Magnetic Meridian; True and Magnetic bearings, Fore & Back bearings, Declination. Whole circle bearing system & Quadrantal Bearing system. Conversion of bearings from one system to other. Calculation of angles from bearings. Calculation of bearings from angles.
Professional Skill 100 hrs Professional Knowledge 24 hrs	Perform the site survey using prismatic compass	Chain and compass survey 35. Taking horizontal measurements on sloping ground of mines, overcoming obstacles, measuring distance between two points invisible from each other. 36. Procedure in conducting chain survey. 37. Chain and compass survey of an extensive area, locating details, plotting, finishing in ink & coloring. 38. Graphical adjustment of closing error.	Local attraction: Sources, detection & its elimination. Magnetic Dip & Magnetic declination. Calculation of True bearings. Traversing with compass: Closed and open traverse; Plotting a compass traverse; Checks for open &closed traverse; Closing error,
Professional Skill 100 hrs	Perform different types of levelling activities at site.	**Leveling** 39. Practice in setting up a level & performing temporary adjustments-practice in reading	Definitions of the terms used in Levelling. Concept of datum, Back sight, Foresight stations, change point, height of instrument.

Professional Knowledge 24 hrs		staff, practice of permanent adjustment of dumpy & auto levels. 40. Practicing simple levelling, differential levelling, reciprocal levelling, fly levelling, longitudinal sectioning, cross sectioning and check leveling. 41. Reduction of levels, preparation of sections and working profiles. 42. Setting out gradients.	Dumpy and tilling level Construction and temporary adjustments. Levelling staff, their types. balancing of back sight and Fore sight distances. Holding and Reading the staff, simple and differential levelling, and booking of readings. Reduction of levels by Collimation system and by Rise & fall system. arithmetic check, computation of missing readings.
Professional Skill 160 hrs Professional Knowledge 40 hrs	Perform traverse survey by Theodolite, prepare a site map.	**Contouring** 43. Locating contour lines- direct and indirect methods- interpolation of contours- contour gradient preparation of sections from contour map- computation of volume- by prismoidal formula, trapezoidal formula. 44. Establishment of gradient using abney level, Ceylon ghat tracer and by using boning rod and sight rail. 45. Plotting of contour maps. 46. Uses of contour map.	Introduction and concept, definitions, purpose, Characteristic of Contour line, contour interval, factors affecting contour interval, Horizontal equivalent. Methods of locating contours Direct method, indirect method. Interpolation of contours by estimation, arithmetical and by graphical method. Measurement of areas & volumes by Simpson's and Trapezoidal, prismoidal rule, measurement of stock of coal, overburden in mines.
Professional Skill 160 hrs Professional Knowledge 50 hrs	Perform the site survey using the plane table.	**Plane table survey** 47. Setting up of plane table, leveling, centering & orientation. 48. Surveying an area with plane table by radiation & intersection methods. 49. Traversing with plane table of built up areas, running an open traverse with plane table & fixing details. 50. Practice in finding the position of table by three point & two point problems.	Introduction, Plane table and its accessories, Temporary adjustments of Plane table, centering, levelling, orienting the plane table by method of back sighting by method of magnetic needle. Methods of plane tabling Radiation, Intersection, Traversing, Resection method. Advantages & disadvantages of plane table survey, Errors in plane table survey.

		51. Use of tangent &Disle's clinometers-Abney level and telescopic alidade for finding heights of surrounding points.	
Professional Skill 160 hrs Professional Knowledge 50 hrs	Perform Theodolite survey.	**Theodolite survey** 52. Practice to set up the theodolite and to read the verniers, booking. 53. Performing the permanent adjustments of theodolite. 54. Measurement of horizontal angle by various methods, setting out angles, measurement of vertical angle, deflection angle and prolongation of lines by various methods. 55. Traversing (closed and open) using theodolite and steel tape measurement of horizontal angles, bearings of lines. 56. Plotting of traverse by co-ordinates, computation of area using co ordinates.	Classification of theodolite, definitions and terms used in operating theodolite. Temporary adjustments of transit theodolite. Fundamental axes of Theodolite. Measurement of horizontal and vertical angles. Observe magnetic bearing of a line. Use of theodolite for Prolonging a straight line, for lining in, Lay-off horizontal angle. Sources of errors in theodolite work and their elimination. Permissible errors in mine surveyor. Methods of traversing, by included angles& Deflection angles. Checks in closed & open traverse. Traverse computation: latitude, departure.
Professional Knowledge WSC: 40 hrs ED: 38 hrs	Read and apply engineering drawing for different application in the field of work. Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Workshop Calculation & Science Unit, Fractions** Classification of unit system Fundamental and Derived units F.P.S, C.G.S, M.K.S and SI units Measurement units and conversion Factors, HCF, LCM and problems Fractions - Addition, substraction, multiplication & division Decimal fractions - Addition, subtraction, multilipication & division Solving problems by using calculator **Square root, Ratio and Proportions, Percentage** Square and suare root Simple problems using calculator Applications of pythagoras theorem and related problems Ratio and proportion Ratio and proportion - Direct and indirect proportions Percentage	Engineering Drawing: Introduction to Engineering Drawing and Drawing Instruments – • Conventions • Sizes and layout of drawing sheets • Title Block, its position and content • Drawing Instrument 2 2. Free hand drawing of – • Geometrical figures and blocks with dimension • Transferring measurement from the given object to the sketches. • Free hand drawing of hand tools and measuring tools. 6 3. Drawing of Geometrical figures: • Angle, Triangle, Circle, Rectangle, Square, Parallelogram. 8 4. • Reading of dimension and Dimensioning Practice. 4 5. Symbolic representation – • Different

		Precentage - Changing percentage to decimal and fraction **Material Science** Physical and mechanical properties of metals Difference between iron & steel, alloy steel and carbon steel **Mass, Weight, Volume and Density** Mass, volume, density, weight and specific gravity Related problems for mass, volume, density, weight and specific gravity **Heat & Temperature and Pressure** Concept of heat and temperature, effects of heat, difference between heat and temperature, boiling point & melting point of different metals and non-metals Scales of temperature, celsius, fahrenheit, kelvin and conversion between scales oftemperature Co-efficient of linear expansion **Mensuration** Area and perimeter of square, rectangle and parallelogram Area and perimeter of Triangles Area and perimeter of circle, semi-circle, circular ring, sector of circle, hexagon and ellipse Surface area and volume of solids - cube, cuboid, cylinder, sphere and hollow cylinder Finding the lateral surface area, total surface area and capacity in litres of hexagonal, conical and cylindrical shaped vessels **Trigonometry** Measurement of angles, Trigonometrical ratios Trigonometrical tables	symbols used in the trades. 8 6. Reading of Plan drawing 12
115 hrs	**Revision /Project work**		
40 hrs	**Examination**		

SYLLABUS – MINE SURVEYOR

SECOND YEAR			
Hours.	**Reference Learning Outcome**	**Professional Skills (Trade Practical)**	**Professional Knowledge (Trade Theory)**
Professional Skill 192 hrs Professional Knowledge 50 hrs	Perform curve survey.	**Curve survey** 57. Simple curve-computation of elements of simple curve- set out of simple curves by linear and angular methods. 58. Road project-reconnaissance, preliminary & final location survey including preparation of route map, traversing, levelling, preparation of sections, computation of earth work and other materials for laying the mine road.	Classification of curves. Definition of various parts of curves, Elements of simple circular curve, Relation between radius of curve & degree of curve. Setting out curves by Linear methods and single theodolite method. Super elevation or cant. Purpose of super elevation to prevent derailment in mines.
Professional Skill 192 hrs Professional Knowledge 50 hrs	Perform Correlation survey.	**Correlation survey** 59. Direct traversing through incline, by plumbing wires in shaft, coplannining method, weisbach triangle method, Weiss quadrilateral method, Gyro- theodolite method.	Marking of underground stations. Correlation Survey- Direct traversing through incline, by plumbing wires in shaft, coplannining method, weisbach triangle method, Weiss quadrilateral method, Gyro-theodolite method
Professional Skill 192 hrs Professional Knowledge 50 hrs	Perform Shaft and drift survey.	**Shaft and drift survey** 60. Transferring levels underground: Measurement of depth of vertical shaft. 61. Establishing u/g bench mark in relation to surface bench mark. 62. Marking center & grade line of drift. 63. Marking Highest flood level. 64. Connection of mine plan to national Grid.	Introduction, Definition of Dip, Strike. Apparent dip, Full dip, Numerical for determining true and apparent dip, strategical thickness of seam. Definition of Fault. Normal fault, Reverse fault. Numerical on fault problems.
Professional Skill 157 hrs	Perform Stope survey.	**Stope survey** 65. Stope survey in flat deposit: Tape triangulation, Tie Method, instrumental method.	Definition & Purpose of stope survey. Classification of stope surveying Methods of stope surveying. Stope survey in flat deposit: Tape triangulation, Tie

Professional Knowledge 50 hrs		66. Stope survey in steeply inclined deposit. 67. Stope survey in massive ore bodies, irregular in dip & shape.	Method, instrumental method. Stope survey in steeply inclined deposit. Stope survey in massive ore bodies, irregular in dip & shape.
Professional Skill 156 hrs Professional Knowledge 50 hrs	Perform Tacheometric survey.	**Tacheometric survey** 68. Determination of horizontal and vertical distance by tacheometric method**.** 69. Enlargement and reduction of plans and maps using pentagraph and proportionate compass.	Instruments. Requirement of a tacheometer Tachometric methods : Fixed hair method; Reduction formula for horizontal distance & elevation with horizontal sights
Professional Skill 192 hrs Professional Knowledge 50 hrs	Measure area and volume using of digital theodolite and determine area by planimeter.	**Measurement of area and volume** 70. Setting up of digital theodolite. 71. Measurement of horizontal and vertical anglestraver sings using digital theodolite. 72. Determination of area by planimeter. 73. Measurement of displacement, slope and subsurface movement, frequency of subsidence measurement.	Study and use of Planimeter including digital planimeter. Subsidence monitoring, data required for subsidence studies, parameters required during monitoring, layout of survey lines, survey stations, measurement techniques and Instrumentation.
Professional Skill 192 hrs Professional Knowledge 55 hrs	Prepare Mine plans and sections.	**Mine plans and sections** 74. Preparation of plans by mine surveyors. 75. Types of plan, copies of plans & sections to be submitted.	General requirements of mine plan, Types of plan, copies of plans & sections to be submitted, plans & sections to be submitted after abandonment and discontinuance, list of plans, sections and instruments and their storage, Preparation of plans by surveyors. Duties and responsibility of Mine Surveyors.
Professional Skill 192 hrs Professional Knowledge 55 hrs	Perform survey by using Total Station and prepare the site map	**Advanced survey instruments** 76. Temporary adjustments of Total Station. 77. Measurements of angles measurements of co-ordinates determination of height.	Global Positioning System; Principle, The system, application in Opencast mine surveyor, Advantages and Disadvantages. Total station; application in distance measurement, angle measurement. Electronic

		78. Determination of area Traversing (open and closed) using total station Determination of the co-ordinates of the points using GPS.	Distance Measurement; Principle of measurement, types etc. Gyro-theodolite; principle of gyro, gyro attachments. Laser plummet.
Professional Knowledge WSC: 40 hrs	Demonstrate basic mathematical concept and principles to perform practical operations. Understand and explain basic science in the field of study.	**Workshop Calculation & Science** **Area of cut out regular surfaces and area of irregular surfaces** Area of cut out regular surfaces - circle, segment and sector of circle Related problems of area of cut out regular surfaces - circle, segment and sector of circle Area of irregular surfaces and application related to shop problems **Algebra** Algebra - Addition , subtraction, multiplication & division Algebra - Theory of indices, algebraic formula, related problems **Profit and Loss** Profit and loss - Simple problems on profit & loss **Estimation and Costing** Estimation and costing - Simple estimation of the requirement of material etc., as applicable to the trade Estimation and costing - Problems on estimation and costing	
115 hrs	**Revision/ Project work**		
40 hrs	**Examination**		

9. SYLLABUS - CORE SKILLS

SYLLABUS FOR CORE SKILLS
1. Employability Skills (Common for all trades) (120 Hrs + 60 Hrs)

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

ANNEXURE-I

List of Tools and Equipment			
MINE SURVEYOR (For batch of 20 candidates)			
S No.	**Name of the Tools and Equipment**	**Specification**	**Quantity**
A. TOOLS, EQUIPMENT &GENERAL OUTFIT			
1.	Engineering Instrument Box	15 cm	21 Nos.
2.	Protractor full circular		21 Nos.
3.	Card board/ plastic metric scale set- A to H		21 Nos.
4.	Diagonal scale, electroplated		21 Nos.
5.	Celluloid set square	45˚ & 60˚	21 Nos.
6.	T square / Mini drafter	1250 mm	21 Nos.
7.	Erasing shield small size		21 Nos.
8.	Architect's & builder's template		21 Nos.
9.	Chisel- steel blade	80 mm	21 Nos.
10.	French curve- set of 12		21 Nos.
11.	Abney level		8 Nos.
12.	Ammonia printing machine with box		8 Nos.
13.	Box sextant		8 Nos.
14.	Boning rod		8 Nos.
15.	Binocular		8 Nos.
16.	Chalk board/White board		2 Nos.
17.	Cupboard (Big)		2 Nos.
18.	Ceylon ghat tracer with stand & target		8 Nos.
19.	Scientific calculator		8 Nos.
20.	Computing scales two hectares		21 Nos.
21.	Computing scales five hectares		21 Nos.
22.	Wooden cross staff- box type		21 Nos.
23.	Wooden cross staff- open type		21 Nos.
24.	Drawing Board with stand	1250mm X 900mm	8 Nos.
25.	Engineer's chain		8 Nos.
26.	Engineer's level		8 Nos.
27.	Dumpy level		8 Nos.
28.	Hold all canvas for instruments		21 Nos.
29.	Leveling staff - telescopic type		21 Nos.

30.	Auto level		8 Nos.
31.	Tilting level		8 Nos.
32.	Fire extinguisher		8 Nos.
33.	Gunter's chain		8 Nos.
34.	Hand press for numbering & lettering		21 Nos.
35.	Canvas bag		5 Nos.
36.	Height indicators		8 Nos.
37.	Metric chain	30 m & 20 m 5 each	8 Nos.
38.	Magnifying glass		8 Nos.
39.	Magnet bar (for magnetizing through compass needles		8 Nos.
40.	Plastic tubes for keeping drawings		8 Nos.
41.	Pen knife		8 Nos.
42.	Pentograph		8 Nos.
43.	Prismatic compass		8 Nos.
44.	Planimeter (digital)		8 Nos.
45.	Proportionate compass		8 Nos.
46.	Ranging rod	4 m	8 Nos.
47.	Indian pattern clinometers		8 Nos.
48.	Offset rod		8 Nos.
49.	Optical square		8 Nos.
50.	Railway curves-Set of 50 in a box		8 Nos.
51.	Telescopic alidade		8 Nos.
52.	Plane table with stand , accessories & water proofing cover		21 Nos.
53.	Survey plotting scale-8 scales with offset scale in box		21 Nos.
54.	Stencil set		21 Nos.
55.	Substance bar		21 Nos. Each
56.	Metallic tape	30 m	21 Nos.
57.	Metallic tape	20 m	21 Nos.
58.	Steel tape	30 m	8 Nos.
59.	Steel band	30 m & 20 m	8 Nos.
60.	Surveyor's umbrella		8 Nos.
61.	Theodolite transit		8 Nos.
62.	Digital Theodolite		8 Nos.

63.	Rules ebonite plain for drawing lines		8 Nos.
64.	Wooden set square, T square & Compass in a box		8 Nos.
65.	Total station –Leica		8 Nos.
66.	Hand GPS-latest version		8 Nos.
67.	Drawing sheet-A1 size		8 Nos.
68.	Field book as required for the survey work		8 Nos.
69.	Tracing paper roll		8 Nos.
70.	Drawing pencil	HB, 2H, H, etc.	8 Nos.
71.	Eraser		8 Nos.
72.	Adhesive tape		8 Nos.
73.	Drawing pen/ Rotring pen		8 Nos.
74.	Drawing ink		8 Nos.
75.	Color pencil		8 Nos.
76.	Ammonia paper roll		8 Nos.
77.	Ammonia liquid		8 Nos.
78.	Machine-made drawing paper		8 Nos.
79.	Xerox paper A3 & A4 size		8 Nos.

Tools & Equipment for Employability Skills		
S No.	**Name of the Equipment**	**Quantity**
1	Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software	20 no.
2	UPS - 500VA	20 no.
3	Scanner cum Printer	1 no.
4	Computer Tables	20 no.
5	Computer Chairs	20 no.
6	LCD Projector – One in each class room	One in each class room
7	White Board 1200mm x 900mm	One in each class room

Annexure II

Trainee Internal Assessment Report							
Name :					**Batch No:**		
Card ID No :					**Dept:**		
Attendance % :							
Quarters	**Month**	**Attend %**	**Month**	**Attend %**	**Month**	**Attend %**	**Quarterly Average Attend. %**
Qtr-1							
Qtr-2							
Qtr-3							
Qtr-4							

General Assessment **Assessment Period :**

S.No	ATTRIBUTES		Score Qtr-1	Score Qtr-2	Score Qtr-3	Score Qtr-4	Score Sum of 4-Qtrs
1	**Safety**	Knowledge, follow safety precautions and rules					
2	**Sense of Responsibility**	Does he obey Sup/Line i/c instructions					
		Does he attend shift start meetings regularly					
		Does he take supervisors feedback properly					
		Whether he takes planned leaves					
		Does he participates in new drives					
		Does he take care in handling tools					
		Is Punctual					
		Positive, Behaviour, response, learning					
		Maintain 5S at his work station					
		Co-operation - Consider team work, willingness to work with and for others					
		Able to identify and report irregularities at his work place					
3	**Method**	Follow WIS/MOS					
		Able to check faults of previous station					
		Understands tools/equipment functions and its different parts					
		Able to perform the job independently					
4	**Speed**	Able to match line "TACT" time					
		Willingness to learn/flexibility for alternate job					
		Work completion/target achievement					
5	**Quality**	Able to contain defects					
		Awareness about GCA/PDI					
		Skill acquired during "On job training"					
		Total Score					
		Max. Marks					

(Fill score in relevant box) **Excellent : 4, Very Good : 3, Good : 2, Fair : 1, Need Improvement : 0**

Remarks (Supervisor): (Mention achievement/Critical incidents)				
Remarks (Shift Incharge/Dept, Manager):				
Remarks (MSTA Training Coordinator):				