Kandula Srinivasa Reddy Memorial College of Engineering (Autonomous)

Kadapa-516003. AP

(Approved by AICTE, Affiliated to JNTUA, Ananthapuramu, Accredited by NAAC)

(An ISO 9001-2008 Certified Institution)

Department of Civil Engineering

Certification Course

on

Advanced surveying equipments and its applications

Course Instructor:

Prof. V. Giridhar,

Professor, Civil Engg. Dept., KSRMCE

Course Coordinator:

Miss. V. Sai Neeraja and Sri M. Rajasekhar,

Assistant Professor, Civil Engg. Dept., KSRMCE

Date: 12/04/21 to 30/04/21

K.S.R.M. COLLEGE OF ENGINEERING

(UGC-AUTONOMOUS)

Kadapa, Andhra Pradesh, India– 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.

An ISO 14001:2004 & 9001: 2015 Certified Institution

Lr./KSRMCE/CE/2020-21/ Date: 05-04-2021

From
Miss. V. Sai Neeraja and Sri M. Rajasekhar,
Asst. Professor,
Course Coordinator,
Dept. of Civil Engineering,
KSRMCE,
Kadapa.

To
The Principal,
KSRMCE,
Kadapa.

Sub: Permission to Conduct Certificate Course – Reg.

Respected Sir,

The Department of Civil Engineering is planning to offer a certification course on "Advanced surveying equipments and its applications" for B. Tech. students of Civil Engineering. The course will start on 12th Apr. 2021 and the course will run for a total number of 30 hours. In this regard, I am requesting you to accept the proposal to conduct certification course.

Thanking you

Yours faithfully

(Miss. V. Sai Neeraja and Sri M. Rajasekhar)

Permitted
V. S. S. Murthy

K.S.R.M. COLLEGE OF ENGINEERING
(UGC-AUTONOMOUS)
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An ISO 14001:2004 & 9001: 2015 Certified Institution

Cr./KSRMCE/CE/2020-21/

Date: 06/04/2021

Circular

The Department of Civil Engineering is offering a certification course on Advanced surveying equipments and its applications. The course will start on 12-04-2021 and the course will run for a total number of 30 hours. In this regard, interested students of Civil Engineering are required to register for the Certification Course. The registration link is given below.

https://docs.google.com/forms/f/g/SmcasEDmkKSAAjdGQRfgSjI21ffsrPJHs38SGEshtdn6GsR4GfNdT10w/viewform

The Course Coordinator
Miss. V. Sai Neeraja and Sri M. Rajasekhar,
Assistant Professor,
Dept. of Civil Engg.- KSRMCE.

V. S. S. Murthy
Principal

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

Cc to:

The Director, KSRMCE

The HoD-Civil, KSRMCE

IQAC-KSRMCE

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Department of Civil Engineering

Registration list of Certification course
on
Advanced surveying equipments and its applications

Sl. No.	Student Roll No.	Student Name	Sec.	Mail ID
1	189Y1A0126	Venkata Jithendhar Reddy Duddekunta	A	189Y1A0126@ksrmce.ac.in
2	189Y1A0132	Lakshmi Prasad Reddy Guddila	A	189Y1A0132@ksrmce.ac.in
3	189Y1A0135	Sreeveni Hasti	A	189Y1A0135@ksrmce.ac.in
4	189Y1A0144	Bhanumanikanta Reddy Kannapu	A	189Y1A0144@ksrmce.ac.in
5	189Y1A0146	Govardhan Kaveti	A	189Y1A0146@ksrmce.ac.in
6	189Y1A0156	Sudheer Kumar Maadam	A	189Y1A0156@ksrmce.ac.in
7	189Y1A0158	Lokeshwar Reddy Mallireddy	A	189Y1A0158@ksrmce.ac.in
8	189Y1A0159	Ganesh Mandla	A	189Y1A0159@ksrmce.ac.in
9	189Y1A0163	Sampath Kumar Meka	B	189Y1A0163@ksrmce.ac.in
10	189Y1A0166	Siva Prasad Reddy Mitta	B	189Y1A0166@ksrmce.ac.in
11	189Y1A0171	Venkata Sai Poojith Nagalla Pati	B	189Y1A0171@ksrmce.ac.in
12	189Y1A0172	Venkatesh Nagirikanti	B	189Y1A0172@ksrmce.ac.in
13	189Y1A0175	Abhish Nanubala	B	189Y1A0175@ksrmce.ac.in
14	189Y1A0179	Jayachandra Sai Pandugolu	B	189Y1A0179@ksrmce.ac.in
15	189Y1A0187	Rakesh Prasanna Penubala	B	189Y1A0187@ksrmce.ac.in
16	189Y1A0193	Bindhu Rachamallu	B	189Y1A0193@ksrmce.ac.in
17	189Y1A0198	Afroz Shaik	B	189Y1A0198@ksrmce.ac.in
18	189Y1A01B0	Sateesh Kumar Reddy Thallapalle	B	189Y1A01B0@ksrmce.ac.in
19	189Y1A01B4	Gayathri Thopudurthy	B	189Y1A01B4@ksrmce.ac.in

20	189Y1A01B8	Venkata Hemanth Usugari	B	189Y1A01B8@ksrmce.ac.in
21	189Y1A01C3	Ganga Swetha Vennapusa	B	189Y1A01C3@ksrmce.ac.in
22	189Y1A01C6	Naga Hema Pranitha Sree Yelikanti	B	189Y1A01C6@ksrmce.ac.in
23	189Y1A01C8	Sivanatha Reddy Yeturu	B	189Y1A01C8@ksrmce.ac.in
24	199Y5A0107	Vijay Kumar Reddy Basireddygari	C	199Y5A0107@ksrmce.ac.in
25	199Y5A0112	Mahesh Babu Chinthakunta	C	199Y5A0112@ksrmce.ac.in
26	199Y5A0116	Pavan Kalyan Dokka	C	199Y5A0116@ksrmce.ac.in
27	199Y5A0117	Dastagiri Dudekula	C	199Y5A0117@ksrmce.ac.in
28	199Y5A0118	Premaraju Erapogu	C	199Y5A0118@ksrmce.ac.in
29	199Y5A0123	Ramu Gosetty	C	199Y5A0123@ksrmce.ac.in
30	199Y5A0127	Venkateswarlu Kashetty	C	199Y5A0127@ksrmce.ac.in
31	199Y5A0132	Mahesh Mallepogu Budigi	C	199Y5A0132@ksrmce.ac.in
32	199Y5A0134	Sai Kumar Mannula	C	199Y5A0134@ksrmce.ac.in
33	199Y5A0138	Reddaiah Nagulugari	C	199Y5A0138@ksrmce.ac.in
34	199Y5A0144	Praveen Kumar Reddy Pathi	C	199Y5A0144@ksrmce.ac.in
35	199Y5A0150	Sambasivareddy Sanikommu	C	199Y5A0150@ksrmce.ac.in
36	199Y5A0155	Sravani Sirigiri	C	199Y5A0155@ksrmce.ac.in
37	199Y5A0157	Siva Krishna Suripaka	C	199Y5A0157@ksrmce.ac.in
38	199Y5A0159	Chandu Thoti	C	199Y5A0159@ksrmce.ac.in

M. Rajasekar

Coordinators

HoD-Civil Engg.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA 516 003. (A.P.)

Syllabus of Certification Course

Course Name: Advanced surveying equipments and its applications

Duration: 30 Hours

Module – I

Introduction about Advanced Surveying Equipments, its applications, Digital levels, Salient features of digital levels, components of digital levels

Module – II

Electronic Distance Measuring Instruments Introduction, Principle of EDMI, Classification of EDMI, Operations of EDMI, Error Sources in EDMI

Module – III

Electronic Theodolite, Total Station, Salient features of Modern Total Station, Parts of Total Station, Field Techniques with Total Station

Module –IV

Usage of Total Station, Advantages of Total station, Applications – Working Procedure of Total Station by using Sokkia – Setting up the total station- Collecting Data- Data Transfer From sokkia to PC- Creating a .DXF file from SDR

Text Books:

1) Gopi Satheesh, R.Sathikumar, N. Madhu, Advanced Surveying: Total Station, GPS, GIS & Remote Sensing, Second Edition, Pearson Education.
2) Gopi Satheesh and R SathikumarA, dvanced Surveying Total Station Gps Gis And Remote Sensing by Gopi Satheesh and R Sathikumar, Pearson India,

Head
Department of Civil Engineering
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V. S. S. Murthy
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Department of Civil Engineering

Certification course on "Advanced surveying equipments and its applications"

Date	Timing	Course Instructor	Topic to be covered
12-04-21	4 PM to 6 PM	Prof. V. Giridhar	Introduction about Advanced Surveying Equipments, its applications
15-04-21	4 PM to 5 PM	Prof. V. Giridhar	Digital levels, Salient features of digital levels, components of digital levels
16-04-21	4 PM to 5 PM	Prof. V. Giridhar	Digital levels, Salient features of digital levels, components of digital levels
17-04-21	9 AM to 5 PM	Prof. V. Giridhar	Electronic Distance Measuring Instruments Introduction, Principle of EDMI, Classification of EDMI, Operations of EDMI, Error Sources in EDMI
19-04-21	4 PM to 5 PM	Prof. V. Giridhar	Operations of EDMI, Error Sources in EDMI
20-04-21	4 PM to 5 PM	Prof. V. Giridhar	Electronic Theodolite, Total Station
22-04-21	4 PM to 5 PM	Prof. V. Giridhar	Salient features of Modern Total Station, Parts of Total Station
23-04-21	4 PM to 6 PM	Prof. V. Giridhar	Field Techniques with Total Station
24-04-21	9 AM to 5 PM	Prof. V. Giridhar	Usage of Total Station, Advantages of Total station, Applications – Working Procedure of Total Station by using Sokkia –
26-04-21	4 PM to 5 PM	Prof. V. Giridhar	Usage of Total Station, Advantages of Total station, Applications – Working Procedure of Total Station by using Sokkia
27-04-21	4 PM to 5 PM	Prof. V. Giridhar	Setting up the total station
28-04-21	4 PM to 5 PM	Prof. V. Giridhar	Collecting Data
29-04-21	4 PM to 5 PM	Prof. V. Giridhar	Data Transfer From sokkia to PC- Creating a .DXF file from SDR
30-04-21	4 PM to 5 PM	Prof. V. Giridhar	Data Transfer From sokkia to PC- Creating a .DXF file from SDR

V. S. S. Murthy

Principal

Instructor:

PRINCIPAL
K.S.R.M. COLLEGE OF ENGINEERING
KADAPA - 516 003. (A.P.)

Coordinators: M. Rajasekhar

K.S.R.M. COLLEGE OF ENGINEERING

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Kadapa,Andhra Pradesh, India– 516 003

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Report

of

Course On Advanced Surveying Equipments and Its Applications.

From 12-04-2021 to 30-04-2021

Target Group	:	**Students**
Details of Participants	:	**38 Students**
Co-coordinator(s)	:	**Miss. V. Sai Neeraja and Sri M. Rajasekhar**
Organizing Department	:	**Civil Engineering**
Venue	:	**Online (google meet)**
		Link: https://meet.google.com/lookup/vsdfpane4

Description:

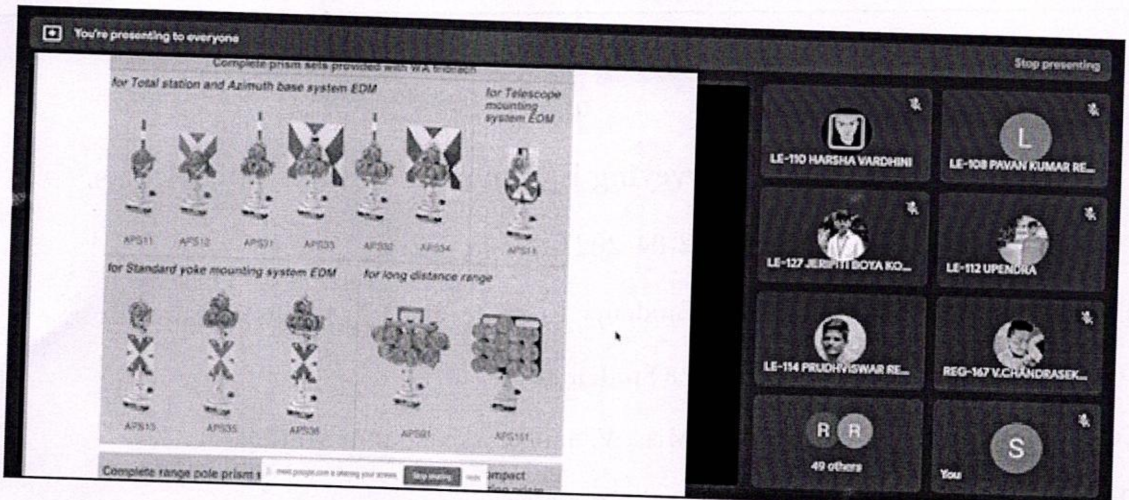
The Department of Civil Engineering offered the certification course on "Advanced Surveying Equipments and Its Applications" from 12-04-2021 to 30-04-2021 and the course was organized for a total number of 30 hours. The course was instructed by Dr. V. Giridhar. (Professor, Dept. Civil Engg.) And coordinated by Miss. V. Sai Neeraja and Sri M. Rajasekhar (Assistant Professor, Dept. of Civil Engg.).

Advanced surveying equipments like EDM'S, Dumpy Level, Total station etc. Total Station is combination of electronic theodolite integrated Electronic distance Measurement, Micro- Processor, Data collector and storage system. This Instrument is digitally observed and record horizontal directions, vertical directions and slope distances. The observed data can be transformed to local X-Y-Z coordinates by using microprocessor. The microprocessor unit is controls, measures, computes, and reduces observations or data by providing commands through keyboard. The data from Total station can be downloaded into computer/laptop by used data collector cable or pen drives. It is mainly used by surveyors and civil engineers to record Topo details like houses, roads and boundaries etc. Total station is also used for fixing alignments or points on ground for Road or Railway Projects etc. B.Tech. Program in Civil Engineering students is having Surveying laboratory which introduces the data collection by using Total station. The present Training Program was arranged to enhance the knowledge on Total Station to students and it will give filed exposure.

The course was designed by considering the students are new to the advanced surveying equipments like Total station. The course started by giving instruction to process setup and brief on various surveying equipments. The course ended by Data collection by using advanced survey equipments .

Photo:

The pictures taken during the course are given below:



(Course Instructor)

(HoD, Civil Engg.)
Head
Department of Civil Engineering
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(Autonomous)
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V. S. S. Murthy
Principal
PRINCIPAL
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Kadapa, Andhra Pradesh, India- 516 003

Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu

ESTD: 1980

DEPARTMENT OF CIVIL ENGINEERING

Certificate Course
on
Advanced Surveying Equipment and its Applications

Resource person

Prof. V. Giridhar

Department of Civil Engineering

Coordinators:

Miss. V. Sai Neeraja and Sri M. Rajasekhar

Assistant Professor

12-04-2021

30-04-2021

Department of Civil Engineering

Attendance sheet of Certification course on Advanced surveying equipments and its applications

Sl. No.	Student Roll No.	Student Name	12/04	15/04	16/04	17/04	19/04	20/04	22/04	23/04	24/04	26/04	27/04	28/04	29/04	30/04
1	189Y1A0126	Venkata Jithendhar Reddy Duddekunta	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	189Y1A0132	Lakshmi Prasad Reddy Guddila	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	189Y1A0135	Sreeveni Hasti	✓	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓
4	189Y1A0144	Bhanumanikanta Reddy Kannapu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	189Y1A0146	Govardhan Kaveti	✓	✓	a	✓	✓	✓	✓	✓	✓	✓	a	✓	✓	✓
6	189Y1A0156	Sudheer Kumar Maadam	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓
7	189Y1A0158	Lokeshwar Reddy Mallireddy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	189Y1A0159	Ganesh Mandla	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9	189Y1A0163	Sampath Kumar Meka	✓	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓	✓
10	189Y1A0166	Siva Prasad Reddy Mitta	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11	189Y1A0171	Venkata Sai Poojith Nagalla Pati	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

12	189Y1A0172	Venkatesh Nagirikanti	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
13	189Y1A0175	Abhish Nanubala	a	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
14	189Y1A0179	Jayachandra Sai Pandugolu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
15	189Y1A0187	Rakesh Prasanna Penubala	✓	✓	✓	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
16	189Y1A0193	Bindhu Rachamallu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17	189Y1A0198	Afroz Shaik	✓	✓	✓	✓	✓	✓	✓	✓	a	✓	✓	✓	✓	✓
18	189Y1A01B0	Sateesh Kumar Reddy Thallapalle	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓
19	189Y1A01B4	Gayathri Thopudurthy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
20	189Y1A01B8	Venkata Hemanth Usugari	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓	✓
21	189Y1A01C3	Ganga Swetha Vennapusa	✓	✓	✓	✓	✓	✓	a	✓	✓	✓	✓	✓	✓	a
22	189Y1A01C6	Naga Hema Pranitha Sree Yelikanti	✓	✓	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓
23	189Y1A01C8	Sivanatha Reddy Yeturu	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a	✓
24	199Y5A0107	Vijay Kumar Reddy Basireddygari	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

25	199Y5A0112	Mahesh Babu Chinthakunta														
26	199Y5A0116	Pavan Kalyan Dokka	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
27	199Y5A0117	Dastagiri Dudekula	✓	✓	✓	✓	a	✓	✓	✓	a	✓	✓	✓	✓	✓
28	199Y5A0118	Premaraju Erapogu	a	✓	✓	✓	✓	a	✓	✓	✓	✓	✓	✓	✓	✓
29	199Y5A0123	Ramu Gosetty	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
30	199Y5A0127	Venkateswarlu Kashetty	✓	✓	✓	✓	✓	✓	a	✓	✓	✓	✓	a	✓	✓
31	199Y5A0132	Mahesh Mallepogu Budigi	✓	✓	✓	✓	a	✓	✓	✓	✓	✓	a	✓	✓	✓
32	199Y5A0134	Sai Kumar Mannula	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
33	199Y5A0138	Reddaiah Nagulugari	✓	✓	a	✓	✓	✓	✓	✓	a	✓	✓	✓	✓	✓
34	199Y5A0144	Praveen Kumar Reddy Pathi	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a
35	199Y5A0150	Sambasivareddy Sanikommu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
36	199Y5A0155	Sravani Sirigiri	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
37	199Y5A0157	Siva Krishna Suripaka	✓	✓	a	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a
38	199Y5A0159	Chandu Thoti	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	a

M. Rajasekhar.

Coordinator

HoD-Civil Engg.

Head
Department of Civil Engineering
K.S.R.M. College of Engineering
(Autonomous)
KADAPA 516 003. (A.P.)

Course Material of Advanced Surveying Equipments and Its Applications

Module – I

Introduction about Advanced Surveying Equipments:

What is surveying?

Surveying is the science and art of determining the relative positions of points above, on, or beneath the earth's surface and locating the points in the field.

The work of the surveyor consists of different phases

1. Decision Making – selecting method, equipment and final point locations.
2. Fieldwork & Data Collection – making measurements and recording data in the field.
3. Computing & Data Processing – preparing calculations based upon the recorded data to determine locations in a useable form.
4. Mapping or Data Representation – plotting data to produce a map, plat, or chart in the proper form.
5. Stakeout – locating and establishing monuments or stakes in the proper locations in the field.

Different categories of Surveying:

1. Plane Surveying – surveying with the reference base for fieldwork and computations are assumed to be a flat horizontal surface.

2. Geodetic Surveying – surveying technique to determine relative positions of widely spaced points, lengths, and directions which require the consideration of the size and shape of the earth. (Takes the earth's curvature into account.)

Types of surveying:

1. Photogrammetry – mapping utilizing data obtained by camera or other sensors carried in airplanes or satellites.
2. Boundary Surveying – establishing property corners, boundaries, and areas of land parcels.
3. Engineering Surveying – providing points and elevations for the building Civil

Engineering projects

4. Topographic Surveying – collecting data and preparing maps showing the locations of natural man-made features and elevations of points of the ground.
5. Route Surveys – topographic and other surveys for long – narrow projects associated with Civil Engineering projects (Highways, railroads, pipelines) 6. Hydrographic Surveying – mapping of shorelines and the bottom of bodies of water.

Instruments used for surveying past decades:

- Chain. • Ranging. • Cross Staff. • Steel band.
- Tape. • Plane tables. • Compass. • Levelling.
- Theodolites. • Tacheometer.
- By the 1970's, relatively small, lightweight and easy-to-use electronic distance measuring devices, called **EDM's** were in use.
- The advance of technology and miniaturization of electronic components enabled the building of theodolites that measure angles electronically, called **Electronic Theodolite**
- Combination of an electronic theodolite and electronic distance meter, and software running on an external laptop computer known as a data collector, called **Total Station**
- The Global Positioning System (GPS) was designed for military applications. Its primary purpose was to allow soldiers to keep track of their position and to assist in guiding weapons to their targets
- A computerized data base management system for capture, storage, retrieval, analysis, and display of spatial data, called **GIS**
- Revolutionary changes have taken place in last few years in surveying instruments that are used for measuring level differences, distances and angles.
- This has become possible because of introduction of electronics in these measurements. With rapid advancements in the technology and availability of cheaper and innovative electronic components, these instruments have become affordable and easy to use.
- The outlines developments in the technology for various survey measurements such as digital levels, electronic distance measuring instruments, electronic theodolites, and total station and gps etc.

Advanced surveying equipments:

- Electronic Theodolite
- EDM – Electronic distance measurement e
- Auto Level.
- Digital Level.
- Laser Level.
- Total station.
- GPS – global positioning system.

Digital levels:

- Traditionally various types of levels have been used for measurement of elevation differences such as
    - dumpy level
    - tilting level
    - automatic level
- Recently electronic digital levels have evolved as a result of development in electronics and digital image processing.
- Digital levels use electronic image processing to evaluate the special bar-coded staff reading.
- The observer is in effect replaced by a detector diode array, which derives a signal pattern from the bar-coded levelling staff.
- This bar-coded pattern is converted into elevation and distance values using a digital image matching procedure within the instrument.
- Automatic data conversion eliminates personal errors in reading the staff and the field data is stored by the instrument on its recording medium,

Salient features of digital levels:

- A digital level offers the following advantages compared to the conventional levelling and recording procedures:
    - Fatigue-free observation as visual staff reading by the observer is not required.
    - User friendly menus with easy to read, digital display of results.
    - Measurement of consistent precision and reliability due to automation.
    - Automatic data storage eliminates booking and its associated errors.
    - Automatic reduction of data to produce ground levels, thereby eliminating arithmetical errors.
    - Fast, economic surveys resulting in saving in time (up to 50% less effort has been claimed by manufacturers)

- Data on the storage medium of the level can be downloaded to a computer enabling quick data reduction for various purposes.
- Digital levels can also be used as conventional levels with the help of dual marked staff (bar coded on one side of the staff for automated reading and conventional graduation on other side of the staff) in case it is difficult to record readings digitally (e.g. for long distances).

Components of digital levels:

The following discussion on digital levels has been primarily taken from Schoffield. Main components of digital level consist of two parts: Hardware (Digital level and levelling staff) and Software.

- Both digital level and associated staff are manufactured so that they can be used for both conventional and digital operations.
- As mentioned earlier, digital levelling staves have dual marking. One side is binary bar-coded for digital recording. For example, Sokkia SDL30 uses a RAB (Random Bi-directional Code) staff. The other side is marked as the conventional staff for conventional staff reading. The staff is made from a glass-fiber-strengthened synthetic materia with low coefficient of thermal expansion for high accuracy. For highest precision work, Invar bar coded staves are also available.

- Typically digital level has the same optical and mechanical components as a normal automatic level. However, for the purpose of electronic staff reading a beam splitter is incorporated which transfers the bar code image to a detector diode array. Figure shows components of a typical digital level The light, reflected from the white elements only of the bar code, is divided into infrared and visible light components by the beam splitter. The visible light passes on to the observer, the infrared to diode array. The acquired bar code image is converted into an analogous video signal, which is then compared with a stored reference code within the instrument.

- The data processing is carried out on a microprocessor and the results are displayed on matrix display. The measurement process is initiated by an interactive keypad and data can be stored onboard.
- Data from digital levels is stored onboard and can be transferred to computer for further processing.
- Various capabilities of digital levels are as follows:
  - measuring elevation

- measuring height difference
- measuring height difference with multiple instrument positions
- levelling
- slope setting
- setting out with horizontal distance
- levelling of ceilings

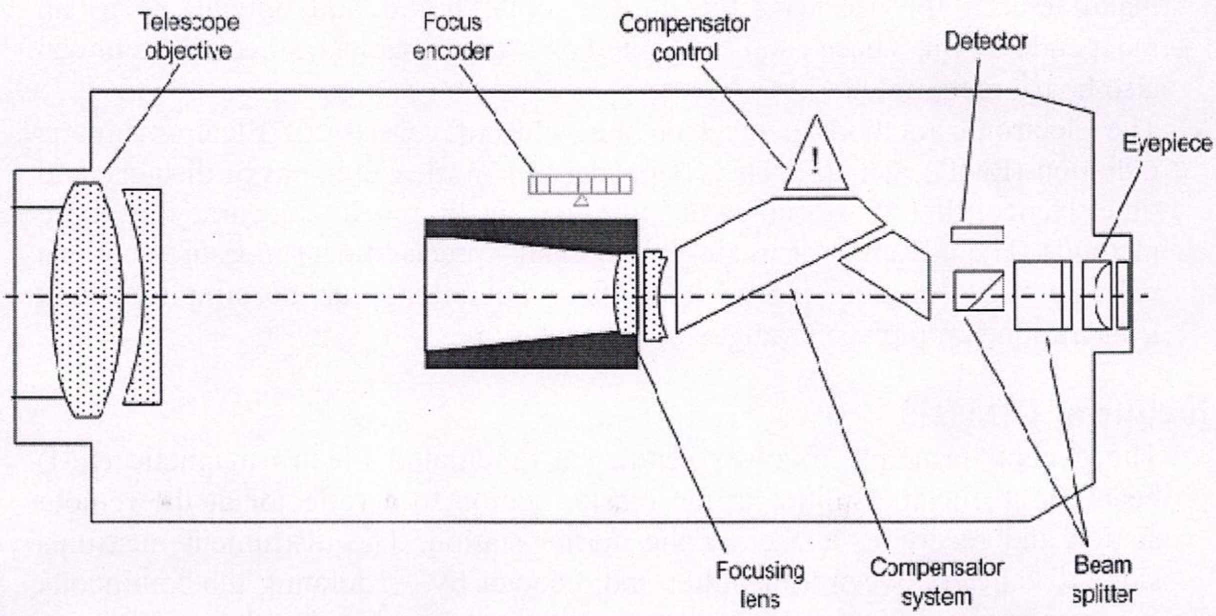


Figure 1.1 Components of a typical digital level

Module- II

Electronic Distance Measuring Instruments (EDMIs):

- EDMIs were first introduced in 1950's by Geodimeter Inc. Early instruments were large, heavy, complicated and expensive. Improvements in electronics have given lighter, simpler, and less expensive instruments. EDMIs can be manufactured for use with theodolites (both digital and optical) or as an independent unit. These can be mounted on standard units or theodolites or can also be tribrach mounted.
- The electronic methods depend on the value of velocity of Electromagnetic radiation (EMR), which itself is dependent upon measurement of distance and time. Hence, there is no inherent improvement in absolute accuracy by these methods. The advantage is mainly functional - precise linear measurement can now be used for longer base lines, field operations can be simplified and trilateration can replace or augment triangulation.

Principle of EDMI:

- The general principle involves sending a modulated Electro-magnetic (EM) beam from one transmitter at the master station to a reflector at the remote station and receiving it back at the master station. The instrument measures slope distance between transmitter and receiver by modulating the continuous carrier wave at different frequencies, and then measuring the phase difference at the master station between the outgoing and the incoming signals. This establishes the following relationship for a double distance (2D):

$$2D = m\lambda + \frac{\phi}{2\pi}\lambda + k$$

- Where *m* is unknown integer number of complete wavelengths contained within double distance, Φ; is the measured phase difference and λ is modulation wavelength, and *k* is constant. Multiple modulation frequencies are used to evaluate *m* , the ambiguity .

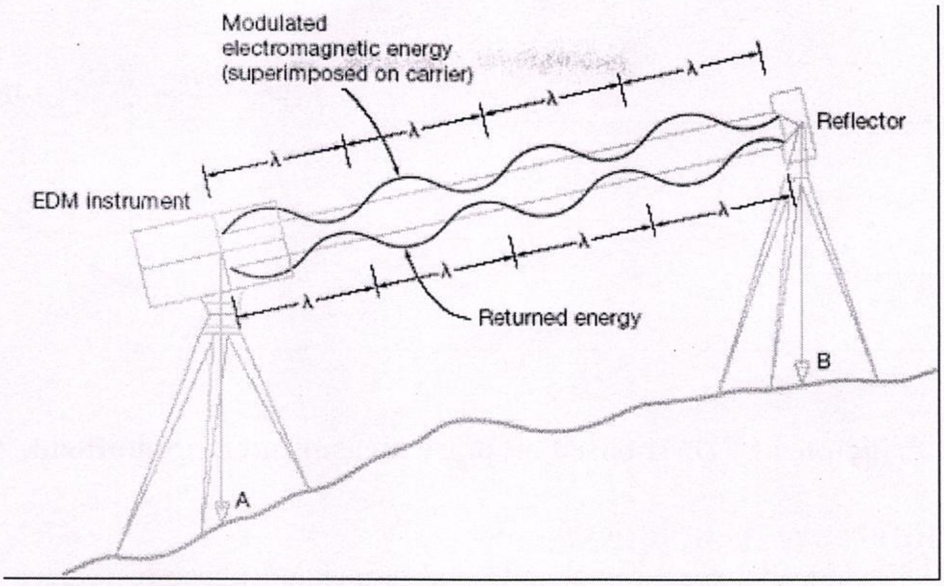


Figure 2.1 Principle of EDMI (Wolf and Ghilani, 2002)

Various EDMIs in use are based on two methods:

- using timed pulse techniques such as those used in variety of radar instruments.
- using measurements of a phase difference which may be equated to one part of a cycle expressed in units of time or length.

Pulse methods have advantages over the phase difference methods but their weight and power requirement is such that they cannot be classed lightweight portable instruments.

(i) Pulse techniques

- All such measurements incorporate a very precise measurement of time usually expressed in units of nanoseconds ($1x10^{-9}$ s), which a EM wave takes to travel from one station to another. In this method, a short, intensive pulse radiation is transmitted to a reflector target, which is immediately transmitted back to the receiver. As shown in Figure 1.4, the distance (D) is computed as the velocity of light (V) multiplied by half the time ($\Delta t/2$) the pulse took to travel back to the receiver ($D = V \times \Delta t/2$).

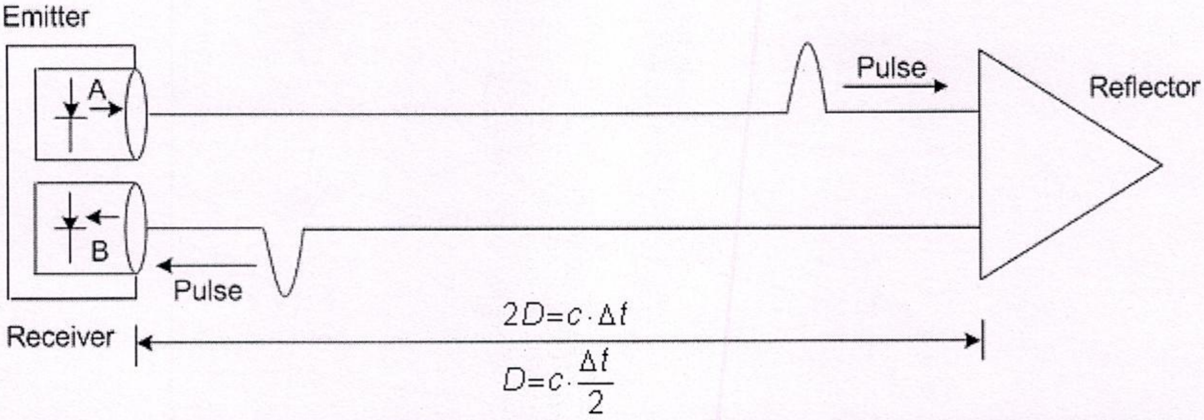


Figure 2.2 Principle of EDMI based on pulse measurement (Schoffield, 2002)

(ii) Phase difference techniques

- The relationship between wavelength and associated phase difference can be illustrated by the Figure 1.5 which shows that for a given complete cycle of EM wave, the phase difference can be expressed both in terms of angular (degrees) and linear (fraction of wavelengths) units. In phase difference method used by majority of EDMI, the instrument measures the amount $\delta\lambda$ by which the reflected signal is out of phase with the emitted signal (Figure 1.6).

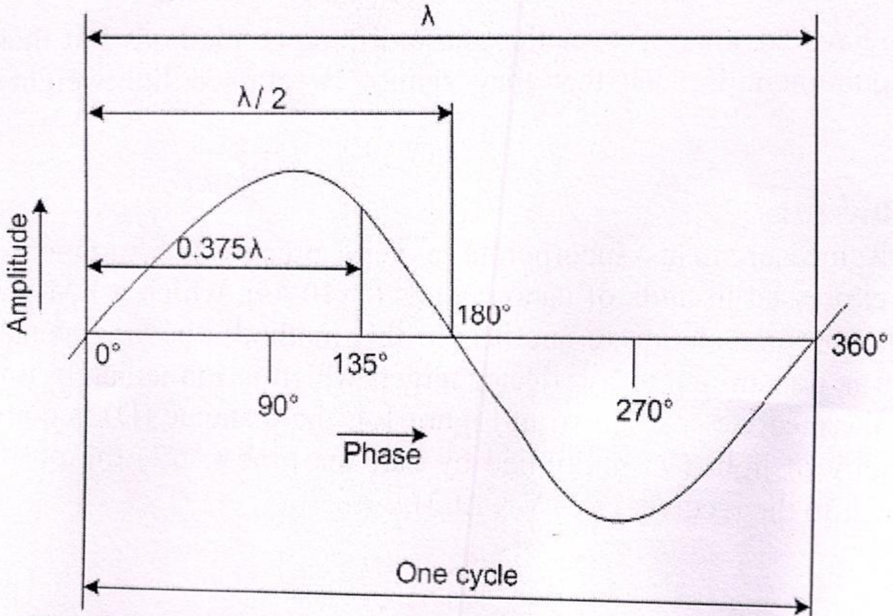
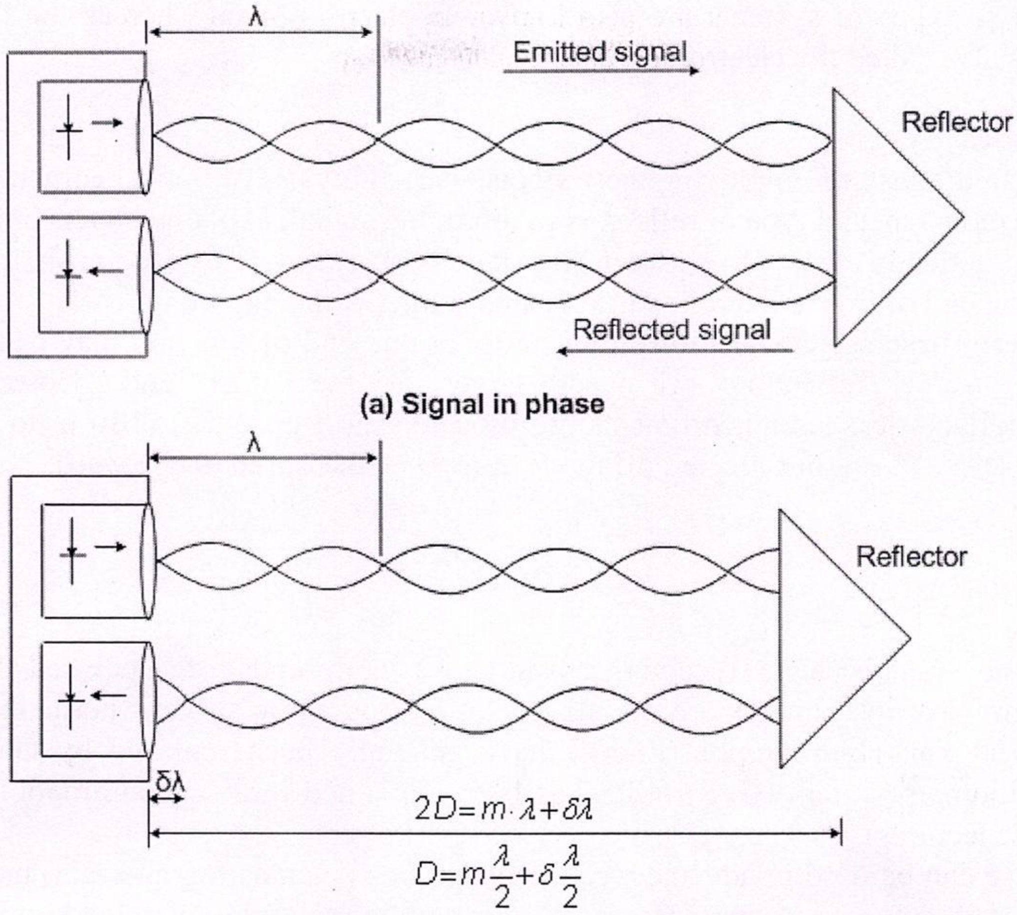


Figure 2.3 Relationship between Wavelength and phase



(b) Signal out of phase

Figure 2.4 Principle of phase measurement (Schofield, 2001)

Classification of EDMI

EDMI can be classified on the basis of three parameters (Schoffield, 2001; Kavanagh, 2003):

1. Wavelength used
2. working range
3. achievable accuracy

(i) Classification on the basis of wavelength

Present generation EDMIs use the following types of wavelengths (Schoffield, 2001):

(a)infrared
(b)laser
(c) microwaves

The first two types of systems are also known as electro-optical whereas the third category is also called the electronic system.

Electro-optical Systems

- Infrared: Systems employing these frequencies allow use of optical corner reflectors (special type of reflectors to return the signal, explained later) but need optically clear path between two stations. These systems use transmitter at one end of line and a reflecting prism or target at the other end.
- Laser: These systems also use transmitter at one end of line and may or may not use a reflecting prism or target at the other end. However, the reflectorless laser instruments are used for short distances (100 m to 350 m). These use light reflected off the feature to be measured (say a wall).

Electronic System

Microwave

- These systems have receiver/transmitter at both ends of measured line. Microwave instruments are often used for hydrographic surveys normally up to 100 km. Hydrographic EDMIs have generally been replaced by Global Positioning System (GPS) (GPS has been explained in a separate module in these lectures).
- These can be used in adverse weather conditions (such as fog and rain) unlike infrared and laser systems. However, uncertainties caused by varying humidity over measurement length may result in lower accuracy and prevent a more reliable estimate of probable accuracy.
- Existence of undesirable reflections and signal leakage from transmitter to the receiver requires the use of another transmitter at the remote station (also called the slave station). The slave station is operated at different carrier frequency in order to separate two signals. This additional transmitter and receiver add to weight of equipment. Multipath effects at microwave frequency also add to slight distance error which can be reduced by taking series of measurements using different frequency.

(ii) Classification on the basis of range

EDMIs are also available as:

- long range radio wave equipment for ranges up to 100 km
- medium range microwave equipment with frequency modulation for ranges up to 25 km
- short range electro-optical equipment using amplitude modulated infra-red or

visible light for ranges up to 5 km

(iii) Classification on the basis of accuracy

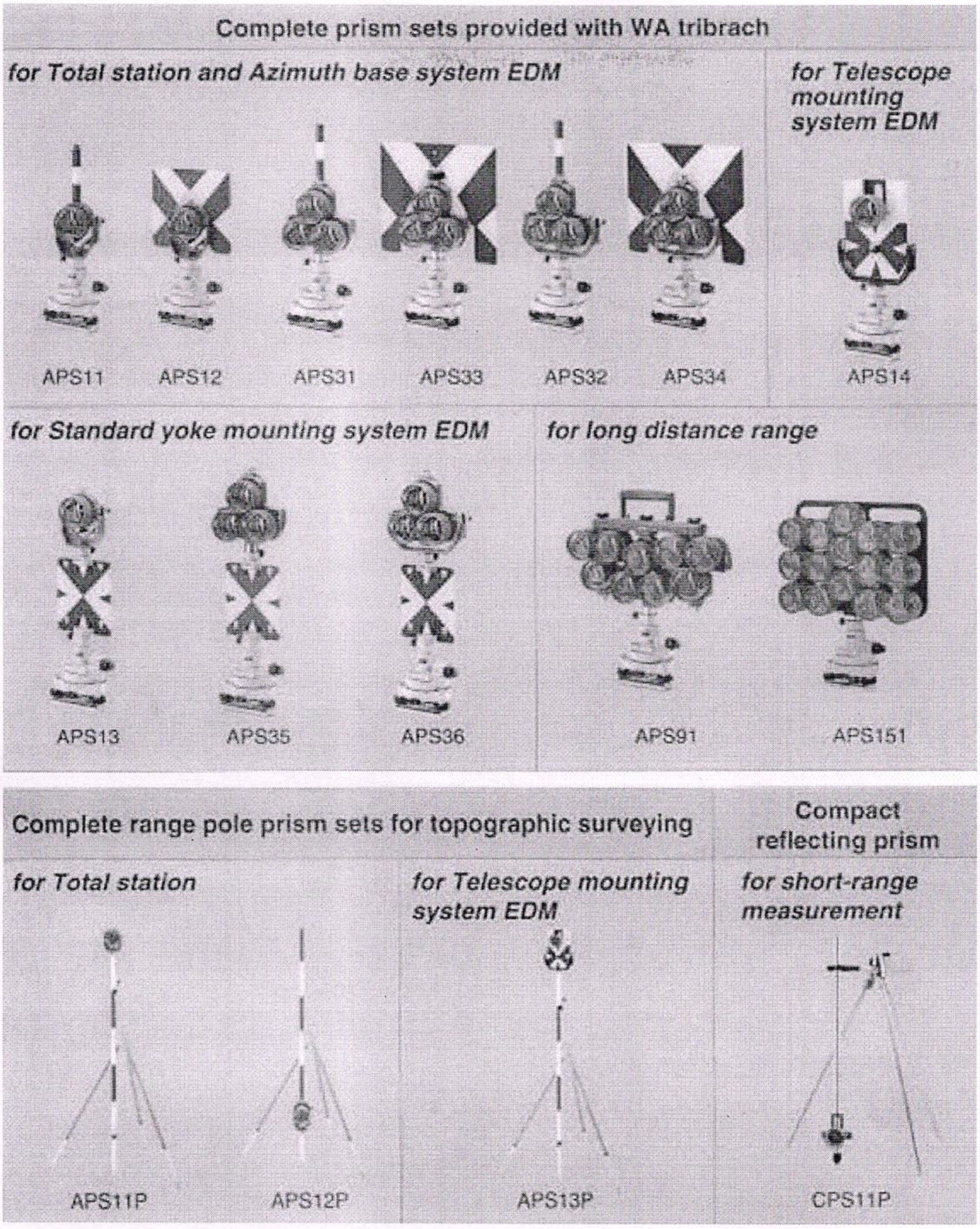
- Accuracy of EDMI is generally stated in terms of constant instruments error and measuring error proportional to the distance being measured: ± (*a* mm + *b* ppm).
    - The first part in this expression indicates a constant instrument error that is independent of the length of the line measured.
    - The second component is the distance related error.
- Here, *a* is a result of errors in phase measurements (θ) and zero error (*z*), whereas *b* results from error in modulation frequency (*f*) and the group refractive index (n_g). The term group index pertains to the refractive index for a combination of waves- carrier wave and multiple modulated waves in EDMI. θ and *z* are independent of distance but *f* and n_g are functions of distance and are expressed as (Schoffield, 2001):

$$a = \sqrt{\sigma_\theta^2 + \sigma_z^2}$$
$$b = \sqrt{(\sigma_f / f)^2 + (\sigma_{n_g} / n_g)^2}$$

- In above equations, σ indicates the standard error. Most EDMI have accuracy levels from ± (3 mm + 1 ppm) to ± (10 mm + 10 ppm). For short distances, part *a* is more significant; for long distances *b* will have large contribution. Table 1.1 lists details of a few EDMIs

Instrument	**Manufacturer**	**Emission source**	**Range (m) (SIngle Prism)**	**Accuracy (mean square error)**
Short Range				
DI1001	Leica	Infrared	1-800	± (5 mm + 5 ppm)
RED M ini 2	sokkia	Infrared	800	± (5 mm + 3 ppm)
DM-HI	Topcan	Infrared	0.15-800	± (1 mm + 2 ppm)
DM-A5	Topcan	Infrared	0.15-800	± (5 mm + 3 ppm)
ND 20/21	Nikon	Infrared	N/A-700/1000	± (5 mm + 5 ppm)
MD-14/MD-20	Pentax	Infrared	1-1,000/1,600	± (5 mm + 5 ppm)
MA200	Navigation Electronics	Infrared	1,600	± (0.25 mm + 0.5 ppm)

ND-26	Nikon	Infrared	N/A-2,000	± (5 mm + 5 ppm)
DI1600	Leica	Infrared	1-3,000	± (3 mm + 5 ppm)
Intermediate Range				
Geodimeter 220	Geotronics	Infrared	0.2-2,300	± (5 mm + 3 ppm)
DM-S2/DM-S3L	Topcon	Infrared	0.15-2,400	± (5 mm + 3 ppm)
DI2002	Leica	Infrared	1-2,500	± (1 mm + 1 ppm)
RED 2A / RED 2L	Sokkia	Infrared	2,00-3,800	± (5 mm + 5 ppm)
Leica / Kern ME5000	Leica	Laser	20-5,000	± (0.2 mm + 0.2 ppm)
DIOR 3002S	Leica	Infrared	0-6,00 No Prism, 300	± (3.5 mm + 0.2 ppm)
RED 2LV	Sokkia	Infrared	6,000	± (5 mm + 5 ppm)
Eldi 10	Zeiss	Infrared	0.2-7,000	± (5 mm + 3 ppm)
Pulsar 50	Geo-Fennel	Infrared	2-8,000	± (5 mm + 5 ppm)
DI 3000S	Leica	Infrared	1-9,000	± (3 mm + 1 ppm)
Criterian 100	Laser Technology	Laser	1.5-8,000 No Prism, 457	± (90 mm + 50 ppm)
Long Range				
Pro Survey 1000	Laser Atlanta	Laser	1-10,000 No Prism, 850	± 100 mm ± 100 mm
Atlas 2000	Laser Atlanta	Laser	1-10,000 No Prism, 1,500	± 100 mm ± 100 mm
Geodimeter	Geotroincs	Infrared	0.2-14,000	±(5 mm + 1 ppm)
MRA 7	Navigation	Microwave	10-50,000	±(15 mm + 3ppm)



2.5 Different types of prism targets used with Sokkia EDM

Components of EDMI

Figure 2.6 and the list given below indicates major components constituting a typical EDMI

- carrier signal
- modulation signals and modulator
- signal transmitter and signal receiver
- beam splitter
- reflector
- filter
- amplifier
- phase discriminator
- display unit

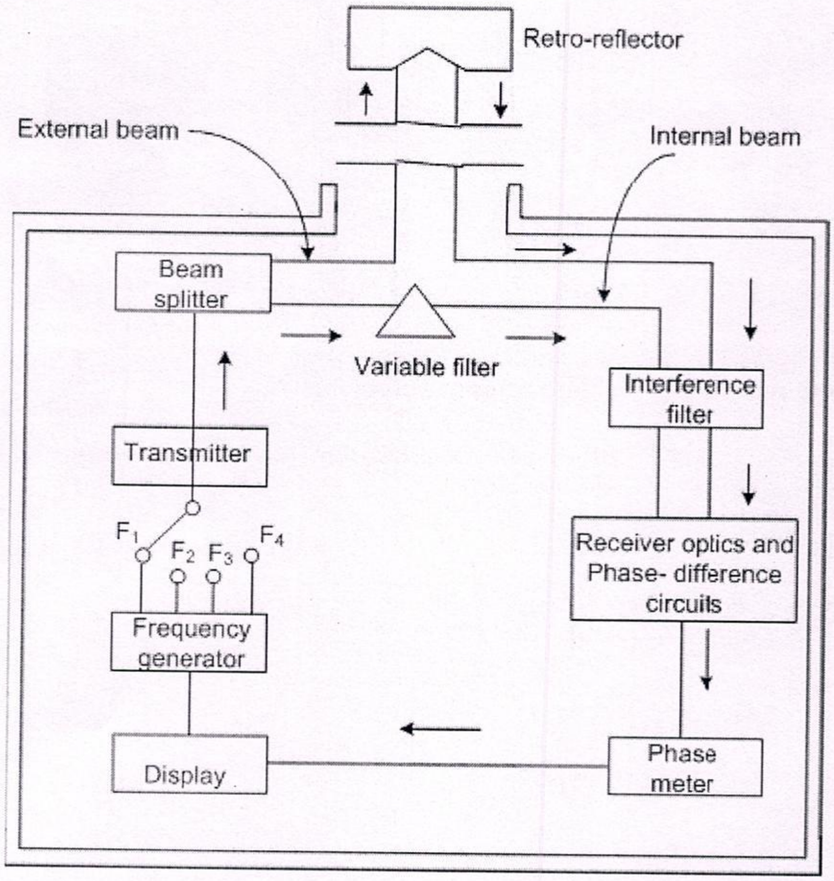


Figure 2.6 Components of a typical EDMI

Operations with EDMI:

- Measurement with EDMI involves four basic steps:
  (a)Setup
  (b) Aim
  (c) Measure
  (d) Record
- Setting up: The instrument is centered over a station by means of tribrach or by mounting over a compatible theodolite. Reflector prisms are set over the remote station either on tribrach or on a prism pole. Observations related to height or instrument and prism are recorded. These are usually kept the same to avoid any additional corrections.
- Aiming: The instrument is aimed at prisms by using sighting devices or theodolite telescope. Slow motion screws are used to intersect the prism centre. Some kind of electronic sound or beeping signal helps the user to indicate the status of centering.
- Measurement: The operator presses the measure button to record the slope distance which is displayed on LCD panel.
- Recording: The information on LCD panel can be recored manually or automatically. All meteorological parameters are also recorded.

Error Sources in EDMI:

Measurement with EDMI has the following error sources which have to be accounted for while reporting the distance
(i) Instrument operation errors
One has to be careful for

- precise centering at the master and slave station
- pointing/sighting of reflector
- entry of correct values of prevailing atmospheric conditions

(ii) Atmospheric errors
Meteorological conditions (temperature, pressure, humidity, etc.) have to be taken into account to correct for the systematic error arising due to this. These errors can be removed by applying an appropriate atmospheric correction model that takes care of different meteorological parameters from the standard (nominal) one.

(iii) Instrument error:
Consists of three components - scale error, zero error and cyclic error. These are

systematic in nature.

Module –III

Electronic Theodolite:

- Theodolites or transits are used to measure horizontal angles. These have evolved as follows:
  - Vernier theodolite (open face and Vernier equipped instruments)
  - Optical theodolite (enclosed with optical readouts with direct digital readouts or micrometer equipped readouts)
  - Electronic theodolites (enclosed with electronic readouts)
- Electronic theodolites operate like any optical theodolite with one major difference that these instruments have only one motion (upper) and hence have only one horizontal clamp and slow motion screws.

Characteristics of electronic theodolites

- Angle least count can be 1" with precision ranging from 0.5" to 20"
- Digital readouts eliminate the personal error associated with reading and interpolation of scale and micrometer settings.
- Display window/unit for horizontal and vertical angles available at either one or both ends.
- Some digital theodolites have modular arrangement where they can be upgraded to be a total station or have an EDMI attached for distance measurements.
- Vertical circles can be set to zero for horizon or zenith along with the status of battery shown in the display window.

Total Station (TS)

- These instruments can record horizontal and vertical angles together with slope distance and can be considered as combined EDM plus electronic theodolite. The microprocessor in TS can perform various mathematical operations such as averaging, multiple angle and distance measurements, horizontal and vertical distances, X, Y, Z coordinates, distance between observed points and corrections for atmospheric and instrumental corrections.
- Due to the versatility and the lower cost of electronic components, future field instruments will be more like total stations that measure angle and distance simultaneously having:
  - all capabilities of theodolites
  - electronic recording of horizontal and vertical angles
  - storage capabilities of all relevant measurements (spatial and non-spatial

attribute data) for manipulation with computer.

- Nowadays surveying systems are available which can be use in an integrated manner with Global Positioning System (GPS). Hence, future theodolites/total stations may have integrated GPS receivers as part of the measurement unit.
- Generally following types of total stations are available in the market:
  - Mechanical/manual
  - Motorized
  - Autolock
  - Robotic/automatic
- Mechanical/manual TS: The conventional multipurpose manual TS are used for routine works with powerful built-in applications program and are cheaper than the other types TS.
- Motorized TS: The motorized TS are equipped with servo to allow for fast, smooth and accurate aiming. This increases the productivity by about 30%. The servo technology enables automated measurement. For example, during angle measurement one can simply aim the instrument at each point. The instrument can then repeat the measurements automatically as may times as required. Servo equipped TS act as base for autolock and robotic surveying.
- Autolock TS: Autolock TS allow for a semi-automatic measurement where measuring and recoding takes place at the TS. In this case the instrument searches for an active remote positioning target (RMT), locks to it and follows the target as it moves to different points. Autolock technology eliminates the need for time-consuming error prone focusing and allows you to work effectively even in poor and low visibility environment. It improves the time efficiency by up to 50%.
- Automatic/Robotic TS: This a true one person surveying TS and is ideal for surveying and stakeout operations. In this TS, the control unit can be taken to the prism to record measurements and collect other data. Generally a radio communication is used between TS and the prism. The control unit, battery, antenna and radio modem are integrated to allow full control over instrument and its operation. The prism used may be omni-directional (usually for short distance up to 500 m) which is always aligned to the instrument or directional for longer distances. During stakeout, the control unit is used to move to point of interest. It improves the time efficiency by up to 80%.

Salient features of modern TS

TS is a fully integrated equipment that captures all the spatial data necessary for a three-dimensional position fix. The angles and distances are displayed on a digital readout and can be recorded at the press of a button. Various components of a typical TS are shown in Figure 3.3 and are described below:

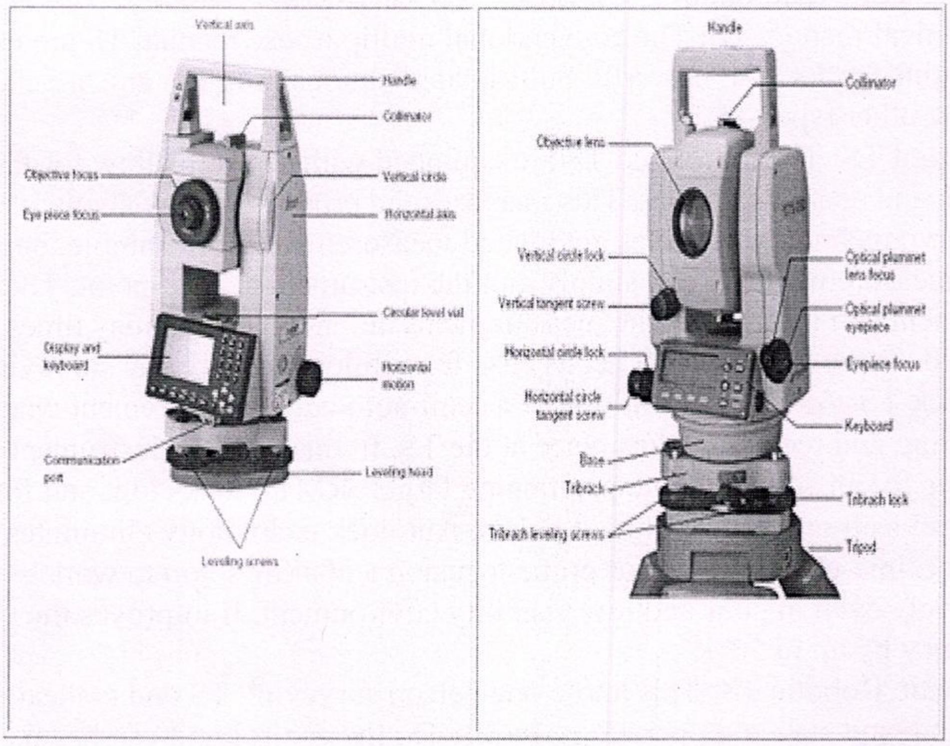


Figure 3.1 Parts of Total Station (a) Eye Piece end (b) Objective end)

A typical TS has the following characteristics:

- Graphic display: All commands for survey operation as well as results are displayed on graphic LCD using alphanumeric keyboard. Using built in software with menu and edit facilities, they automatically reduce angular and linear observations to three dimensional coordinates of the vector observed. Detachable control units are available on particular instruments
- Dual axis compensation: The dual axis tilt sensor monitors any inclination of the standing axis in both X- and Y-directions. These tilt sensors generally have range of 3'. Consequently horizontal and vertical angle readings are free from error due to any deviation of the standing axis from the perpendicular (Figure

3.4). The horizontal and vertical angles are automatically corrected, thus permitting single-face observations without loss of accuracy.

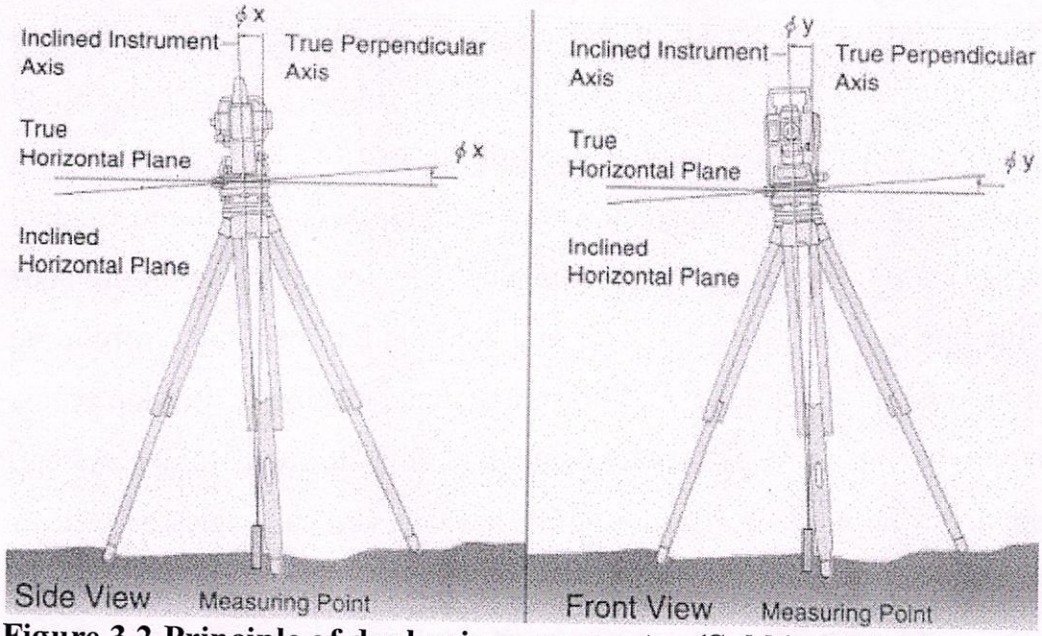


Figure 3.2 Principle of dual axis compensator (Sokkia TS instruments)

- Levelling and centering: A few TS have electronic display for levelling operation enabling rapid and precise leveling. The electronic levelling also eliminates errors caused by direct sunlight on plate bubbles. Laser plummet are replacing the optical plummet. A clearly visible laser dot is projected on to the ground that helps in quick and convenient centering of the instrument.

Field techniques with TS: Various field operations in TS are in the form of wide variety of programs integrated with microprocessor and implemented with the help of data collector. All these programs need that the instrument station and at least one reference station be identified so that all subsequent stations can be identified in terms of (X, Y, Z). Typical programs include the following functions:

- Point location
- Slope reduction
- Missing Line Measurement
- Resection
- Azimuth Calculation
- Offset Measurements
- Layout or Setting out operation
- Stake out

Module -IV

A **"Total Station"** is an electronic / optical instrument used in modern surveying. The total station is an electronic theodolite (transit) integrated with an electronic distance meter (EDM) to read slope distances from the instrument to a particular point. Robotic total stations allow the operator to control the instrument from a distance via remote control. This eliminates the need for an assistant staff member as the operator holds the reflector and controls the total station from the observed point. It is combination of EDM instrument and electronic theodolite. It is also integrated with microprocessor, electronic data collector and storage system. The instrument can be used to measure horizontal and vertical angles as well as sloping distance of object to the instrument.

Microprocessor unit processes the data collected to compute:

(a) Average of multiple angles measured

(b) Average of multiple distance measured

(c) Horizontal distance

(d) Distance between any two points

(e) Elevation of objects and

(f) All the three coordinates of the observed points.

Usage of total station:

A total station is a combination of electronic transit and electronic distance measuring device (EDM). With this device, as with a transit and tape, one may determine angles and distances from the instrument to points to be surveyed. With the aid of trigonometry, the angles and distances may be used to calculate the actual positions (x, y, and z or northing, easting and elevation) of surveyed points in absolute terms.

A standard transit is basically a telescope with cross-hairs for sighting a target; the telescope is attached to scales for measuring the angle of rotation of the telescope (normally relative to north as 0 degrees) and the angle of inclination of the telescope (relative to the horizontal as 0 degrees). After rotating the telescope to aim at a target, one may read the angle of rotation and the angle of inclination from a scale. The electronic transit provides a digital read- out of those angles instead of a scale; it is both more accurate and less prone to errors arising from interpolating between marks on the scale or from mis-recording. The readout is also continuous; so angles can be checked at any time.

The other part of a total station, the electronic distance measuring device or EDM, measures the distance from the instrument to its target. The EDM sends out an infrared beam which is reflected back to the unit, and the unit uses timing measurements to calculate the distance traveled by the beam. With few exceptions, the EDM requires that the target be highly reflective, and a reflecting prism is normally used as the target. The reflecting prism is a cylindrical device about the diameter of a soft-drink can and about 10 cm. in height; at one end is a glass covering plate and at the other is a truncated cone with a threaded extension. It is normally screwed into a target/bracket on the top of a pole; the pointed tip of the pole is placed on the points to be surveyed.

The total station also includes a simple calculator to figure the locations of points sighted. The calculator can perform the trigonometric functions needed, staring with the angles and distance, to calculate the location of any point sighted.

Many total stations also include data recorders. The raw data (angles and distances) and/or the coordinates of points sighted are recorded, along with some additional information (usually codes to aid in relating the coordinates to the points surveyed).

The data thus recorded can be directly downloaded to a computer at a later time. The use of a data recorder further reduces the potential for error and eliminates the need for a person to record the data in the field.

The determination of angles and distance are essentially separate actions. One aims the telescope with great care first; this is the part of the process with real potential for human error. When the telescope has been aimed, the angles are determined. Only then does one initiate the reading of the distance to the target by the EDM. That takes only a few seconds; the calculations are performed immediately.

The total station is mounted on a tripod and leveled before use. Meanwhile, the prism is mounted on a pole of known height; the mounting bracket includes aids for aiming the instrument. The prism is mounted so that its reflection point is aligned with the center of the pole on which it has been mounted. Although the tip of the pole is placed on the point to be surveyed, the instrument must be aimed at the prism. So it will calculate the position of the prism, not the point to be surveyed. Since the prism is directly above the tip, the height of the pole may be subtracted to determine the location of the point. That may be done automatically. The pole must be held upright, and a bubble level is attached to give the worker holding the pole a check. It is not as easy as one might expect to hold the pole upright, particularly if there is any wind; as a result, multiple readings may be required.

When the instrument is set up and turned on, it sets itself to be pointing to zero degrees (north) when power is first supplied. The user must then re-set the instrument to zero degrees when it is actually pointing north. There are two adjustment knobs for rotating within the horizontal plane. One rotates the telescope to make a sighting, with the readout of angles displaying changes. The other, however, permits the user to rotate the entire instrument and to keep the current angle unchanged during the process. That effectively re-orients the zero or north setting. That can be very helpful when setting up or re-setting the instrument, but, of course, it can be devastating if one makes that adjustment by mistake and thereby changes the north setting. This particular instrument was designed in such a way that it was too easy to re-set the instrument when one only wanted to make a sighting.

The pole is designed to be placed on the survey point in a vertical position; it cannot be placed on a point on the face of a wall. In fact, a prism pole can rarely be placed against the face of a wall because of the bulk of the prism, the pole, and the target to which the prism is attached.

There are two alternate methods for dealing with points on a wall. One is the use of reflecting tape instead of the prism. The other method for dealing with points on a wall involved the use of the prism without its pole and target. Prism can be simply positioned against the point on the wall to be surveyed and take the shot. However, the prism is designed to work on the pole - to give a reading to the center of the pole rather than the back of the prism.

When using reflecting tape or a prism without a pole, the tape or prism hides the point to be surveyed. So the telescope is aimed at the point to be surveyed before interposing either tape or prism and maintained the aim of the instrument while putting the tape or prism in position. That reduces the possible error for angular measurement. In the case of the prism, after it was put into position, the transit operator would direct the person holding the prism so that it was aimed directly back at the instrument.

The survey information was recorded by hand, and the data were then entered into the AutoCAD model. Using that AutoCAD feature, each set of data could be entered accurately, regardless of the transit set-up point. This process is not necessary if a data collector with the most modern of capabilities is available. The data collector can automatically orient all new points to a pre-existing set of survey coordinates.

Advantages of using total station:

The following are some of the major advantages of using total station over the conventional surveying instruments:

a) Field work is carried out very fast.
b) Accuracy of measurement is high.
c) Manual errors involved in reading and recording are eliminated.
d) Calculation of coordinates is very fast and accurate. Even corrections for temperature and pressure are automatically made.
e) Computers can be employed for map making and plotting contour and cross-sections.
f) Contour intervals and scales can be changed in no time.

Applications:

Total stations are mainly used by land surveyors and Civil Engineers, either to record features as in Topographic Surveying or to set out features (such as roads, houses or boundaries). They are also used by archaeologists to record excavations and by police, crime scene investigators, private accident re-constructionists and insurance companies to take measurements of scenes.

Working procedure of total station (make sokkia)

Step 1: Establish primary datum and back sight (if you already have a datum and at least one other known point, proceeds to Step 2).

To use the total station for collecting data of coordinate system, you must first establish a primary datum and other known point as a back-sight. The primary datum and back-sight should be (semi)permanent. It is recommended with metal or wooden stakes.

The primary datum should be given a coordinate in an x,y,z system. If datum coordinates are not available an arbitrary coordinates of 8000N, 2000E, 100Z is adopted. These values are adopted so that all coordinate points collected should have a positive value.

Once the primary datum is made a setup, it is required to establish another as a back- sight. Some of total station does not contain an internal compass, so we typically use an optical transit to set up the back sight.

Transit set-up:

a. Set up the tripod over the primary datum
b. Attach the transit to the tripod
c. Use the plumb bob to center the transit over the datum

Next, choose a point to serve as the back sight. It is recommended for choosing a point at an even distance (e.g. 50 meters) along one of the cardinal directions. This point can be used later to establish grids for mapping, surface collection, or geophysical prospection.

Using the transit and a stadia rod, determine the elevation of the back sight. Record this information, as well as the back sight's 2-dimensional coordinates (e.g.

8050N, 2000E, 101.28Z).

STEP 2: Setting up the total station

a. Mount the battery in the instrument before performing this operation because the instrument will tilt slightly if the battery is mounted after leveling.

b. Attach the total station to the tripod

c. Center the total station using the optical plummet eyepiece

d. Level the bubble level by adjusting the tripod (not the total station). This can be done by extending or retracting the tripod legs, or by pushing they further into the ground remember.

e. Adjust the plate level using the foot screws. First, turn the instrument until the plate level is parallel to two of the foot screws. Adjust the screws until the bubble is centered. Then turn the instrument 90 degrees, and adjust the third foot screw.

f. Turn the instrument again and re-check the plate level.

g. Double check that the instrument is still directly over the datum.

Also: Once the total station is set up and level, do not lean on the tripod or the instrument. This could cause the instrument to come out of level, which will detract from the quality of the data or cause the instrument to stop collecting data.

STEP 3: Choosing a Job

First, turn on the total station. Then next you need to set "job." This will be the file in which you data are saved.

a. On the first screen, Click On Esc go to Meas Mode the MEM button, then hit JOB

b. Under "Job Selection" choose the job you want for both job selection and coordinate job—you can choose by selecting the LIST button.

c. Hit Job Name Edit. Here you can re-name the job

d. Press enter after giving the Job details

e. Check that the appropriate job is showing on this page

STEP 4: Entering the Station Coordinates

a) Come back to Function Mode Click On MAIN MENU, Station Setup then COORD Stn Orientation then click on Stn Coordinate

b) Enter the Northing (N), Easting (E), and Elevation (Z) of the datum (i.e. station coordinate).

c) It is recommended to with coordinates 8000N, 2000E and 100Z for ease of use in the field.

d) Enter the instrument height. This is the vertical distance from the datum to the line on the side of the total station. Use a tape measure here. The height of instrument changes for every instrument set-up

e) Enter the target height. This is the distance from the tip of the stadia rod to the center of the prism. The stadia rod is already marked, but make sure to use the metric side. Usually 1.6m or 1.7m.

f) Then Record REC (if you want to record the primary datum as a data point).

g) Choose "Set H angle"

h) Enter back- sight information (e.g., the information obtained with the optical transit).

i) It will allow you to double check the Station Coordinate. Hit OK, but stop here.

j) Make sure to position the stadia rod over the back- sight, and rotate the total station so that the prism is centered in the viewfinder.

k) The screen should say "Take back sight?" Hit yes **only** after the instrument is correctly positioned. This establishes the coordinate system.

l) Hit ESC once, and choose "Observation."

m) The machine will begin clicking and beeping. It is taking the measurement now.

STEP 5: Collecting Data/Observation

a) Once you hit the "Observation" button in step n above, the machine will begin collecting data. The stadia rod must be kept still as the instrument does this (as it is clicking and beeping).

b) During the beeping, the coordinate data is being collected. After two or three beeps, you can press STOP.

c) Next press REC if you wish to record the data (in step o above, you don't need to record the backsight's coordinate unless you want to.).

d) The instrument will allow you to double check the data and the point number (under which it will be saved—you can edit this if you like). We recommend keeping a hard copy of the data by writing down the information you see on this screen.

e) Next, hit OK.

f) Now you are ready to take another point, by hitting OBS.

g) The normal sequence for taking points is: OBS then STOP REC then OK and continue OBS…

Step 6: Data Transfer from Sokkia to PC

a) Open Sokkialink on computer

b) On the total station, select **MEM**, then **JOB**, then **COMMS OUTPUT**

c) Select job that you want to download (will have an * next to the job name if it hasn't been transferred or saved yet) and press the arrow (return) key to change the point total for the job to "**OUT**"

d) Press **OK**, and then connect the total station to your computer (you will hear a low hum when the computer and total station are connected)

e) In Sokkia link, select **FILE**, then **SEND**, and then **CONNECT** in the new window

f) In the new window on the right ("Device"), The points will collected from Total station

g) In this window save the points data in .SDR file format

h) You should see that the data is saved in .sdr file format

Step 7: Creating a .Dxf file from a .sdr file

a) Open Sokkia link then Click on Data –Total station data

b) Open Data select saved .sdr file and open it

c) Then the points will create in three columns (North, East and elevation Z)

d) Click on Drawing – Do not draw – Ok

e) Then collected Data open in Map Click on File-Dxf- save .Dxf file In Destination Folder

K.S.R.M College of Engineering

(AUTONOMOUS)

KADAPA, ANDHRA PRADESH, INDIA-516003

DEPARTMENT OF CIVIL ENGINEERING

CERTIFICATE OF COURSE COMPLETION

This certificate is presented to

Venkata Jithendhar Reddy D. (Reg. No. 189Y1A0126), Student of KSRM College of Engineering (Autonomous) for successful completion of certification course on "**Advanced surveying equipments and its applications**" offered by Department of Civil Engineering, KSRMCE-Kadapa.

Course Duration: 30 Hours;
From 12/04/21 to 30/04/21

Course Instructor:
Prof. V. Giridhar,
Professor, CE, KSRMCE-Kadapa

Coordinator

Head of the Department

Principal

K.S.R.M College of Engineering

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Coordinator

Head of the Department

Principal

Department of Civil Engineering

Feedback of students on Certification Course on "Advanced surveying equipments and its applications"

Sl. No.	Roll. No.	Name of The Student	Is the course content met your expectations?	Do you understand the operation of advanced survey equipment?	Rate the course instructor	Is this course useful for your Carrier?	Rate the entire course?
1	189Y1A0126	Venkata Jithendhar Reddy Duddekunta	Yes	Yes	Excellent	Yes	5
2	189Y1A0132	Lakshmi Prasad Reddy Guddila	Yes	Yes	Excellent	May be	5
3	189Y1A0135	Sreeveni Hasti	Yes	Yes	Excellent	Yes	5
4	189Y1A0144	Bhanumanikanta Reddy Kannapu	Yes	Yes	Excellent	Yes	4
5	189Y1A0146	Govardhan Kaveti	Yes	Yes	Excellent	Yes	5
6	189Y1A0156	Sudheer Kumar Maadam	Yes	Yes	Excellent	Yes	5
7	189Y1A0158	Lokeshwar Reddy Mallireddy	Yes	Yes	Excellent	May be	5
8	189Y1A0159	Ganesh Mandla	Yes	Yes	Excellent	Yes	5
9	189Y1A0163	Sampath Kumar Meka	Yes	Yes	Excellent	Yes	4
10	189Y1A0166	Siva Prasad Reddy Mitta	Yes	Yes	Excellent	Yes	5
11	189Y1A0171	Venkata Sai Poojith Nagalla Pati	Yes	Yes	Excellent	Yes	5
12	189Y1A0172	Venkatesh Nagirikanti	Yes	Yes	Excellent	May be	5
13	189Y1A0175	Abhish Nanubala	Yes	Yes	Excellent	Yes	5
14	189Y1A0179	Jayachandra Sai Pandugolu	Yes	Yes	Excellent	Yes	5
15	189Y1A0187	Rakesh Prasanna Penubala	Yes	Yes	Excellent	Yes	5

16	189Y1A0193	Bindhu Rachamallu	Yes	Yes	Excellent	Yes	5
17	189Y1A0198	Afroz Shaik	Yes	Yes	Excellent	Yes	5
18	189Y1A01B0	Sateesh Kumar Reddy Thallapalle	Yes	Yes	Excellent	Yes	5
19	189Y1A01B4	Gayathri Thopudurthy	Yes	Yes	Excellent	May be	5
20	189Y1A01B8	Venkata Hemanth Usugari	Yes	Yes	Excellent	Yes	5
21	189Y1A01C3	Ganga Swetha Vennapusa	Yes	Yes	Excellent	Yes	4
22	189Y1A01C6	Naga Hema Pranitha Sree Yelikanti	Yes	Yes	Excellent	Yes	5
23	189Y1A01C8	Sivanatha Reddy Yeturu	Yes	Yes	Good	Yes	5
24	199Y5A0107	Vijay Kumar Reddy Basireddygari	Yes	Yes	Good	Yes	5
25	199Y5A0112	Mahesh Babu Chinthakunta	Yes	Yes	Excellent	Yes	5
26	199Y5A0116	Pavan Kalyan Dokka	Yes	Yes	Excellent	Yes	5
27	199Y5A0117	Dastagiri Dudekula	Yes	Yes	Excellent	Yes	5
28	199Y5A0118	Premaraju Erapogu	Yes	Yes	Excellent	Yes	5
29	199Y5A0123	Ramu Gosetty	Yes	Yes	Excellent	Yes	5
30	199Y5A0127	Venkateswarlu Kashetty	Yes	Yes	Good	May be	4
31	199Y5A0132	Mahesh Mallepogu Budigi	Yes	Yes	Excellent	Yes	3
32	199Y5A0134	Sai Kumar Mannula	Yes	Yes	Excellent	Yes	5
33	199Y5A0138	Reddaiah Nagulugari	Yes	Yes	Excellent	May be	5
34	199Y5A0144	Praveen Kumar Reddy Pathi	Yes	Yes	Excellent	Yes	5
35	199Y5A0150	Sambasivareddy Sanikommu	Yes	Yes	Excellent	Yes	4

36	199Y5A0155	Sravani Sirigiri	Yes	Yes	Excellent	Yes	5
37	199Y5A0157	Siva Krishna Suripaka	Yes	Yes	Excellent	Yes	5
38	199Y5A0159	Chandu Thoti	Yes	Yes	Excellent	Yes	5

M. Rajasekhar

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