SPPU

According to New Revised Credit System Syllabus

Second Year Degree Course In
CIVIL ENGINEERING (Sem - I)

SURVEYING

Free Seperate MCQ's Book

Includes
- Sample Question Papers (End Sem-50 Marks)
- Univ. Question Papers (Dec.13 to May 17)

ANIL S. SHELAR
Dr. SANDIP T. MALI
UDAY S. PATIL

www.pragationline.com
www.facebook.com/niralibooks

NIRALI PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

A TEXT BOOK OF

SURVEYING

FOR

SEMESTER – I

SECOND YEAR DEGREE COURSE IN CIVIL ENGINEERING

Strictly According to New Revised Credit System Syllabus of Savitribai Phule Pune University

(w.e.f June 2016)

A. S. SHELAR

B.E. M. Tech. (Town & Country Planning),
Senior Lecturer, Civil Engg. Deptt.,
Cusrow Wadia Institute of Technology,
Pune – 1

Dr. S. T. MALI

B.E. (Civil), M.E. (Env.), Ph.D.
Asso. Prof. & Head, Civil Engg. Deptt.,
Pimpri Chinchwad College of Engineering,
Akurdi, Pune.

U. S. PATIL

B.E. M. Tech (C & M),
Asso. Prof. & Head, Civil Engg. Deptt.,
Bharati Vidyapeeth's Group of Institutes Technical Campus,
College of Engineering, Lavale
Lavale, PUNE – 43

Price ₹ 500.00

NIRALI PRAKASHAN
ADVANCEMENT OF KNOWLEDGE

N3530

SURVEYING (SE CIVIL) **ISBN 978-93-86084-04-0**

Second Edition : June 2017

Published By :
NIRALI PRAKASHAN
Abhyudaya Pragati, 1312, Shivaji Nagar,
Off J.M. Road, Pune – 411005
Tel - (020) 25512336/37/39, Fax - (020) 25511379
Email : niralipune@pragationline.com

POLYPLATE

Printed By :
SHREE OM PRINTERS PVT. LTD.
Survey No. 28/25, Dhayri Near Pari Company
PUNE - 411 041
Tel - (020) 24690371

☞ DISTRIBUTION CENTRES

PUNE

Nirali Prakashan : 119, Budhwar Peth, Jogeshwari Mandir Lane, Pune 411002, Maharashtra
Tel : (020) 2445 2044, 66022708, Fax : (020) 2445 1538
Email : bookorder@pragationline.com, niralilocal@pragationline.com

Nirali Prakashan : S. No. 28/27, Dhyari, Near Pari Company, Pune 411041
Tel : (020) 24690204 Fax : (020) 24690316
Email : dhyari@pragationline.com, bookorder@pragationline.com

MUMBAI

Nirali Prakashan : 385, S.V.P. Road, Rasdhara Co-op. Hsg. Society Ltd.,
Girgaum, Mumbai 400004, Maharashtra
Tel : (022) 2385 6339 / 2386 9976, Fax : (022) 2386 9976
Email : niralimumbai@pragationline.com

☞ DISTRIBUTION BRANCHES

JALGAON

Nirali Prakashan : 34, V. V. Golani Market, Navi Peth, Jalgaon 425001,
Maharashtra, Tel : (0257) 222 0395, Mob : 94234 91860

KOLHAPUR

Nirali Prakashan : New Mahadvar Road, Kedar Plaza, 1st Floor Opp. IDBI Bank
Kolhapur 416 012, Maharashtra. Mob : 9850046155

NAGPUR

Pratibha Book Distributors : Above Maratha Mandir, Shop No. 3, First Floor,
Rani Jhanshi Square, Sitabuldi, Nagpur 440012, Maharashtra
Tel : (0712) 254 7129

DELHI

Nirali Prakashan : 4593/21, Basement, Aggarwal Lane 15, Ansari Road, Daryaganj
Near Times of India Building, New Delhi 110002
Mob : 08505972553

BENGALURU

Pragati Book House : House No. 1, Sanjeevappa Lane, Avenue Road Cross,
Opp. Rice Church, Bengaluru – 560002.
Tel : (080) 64513344, 64513355,Mob : 9880582331, 9845021552
Email:bharatsavla@yahoo.com

CHENNAI

Pragati Books : 9/1, Montieth Road, Behind Taas Mahal, Egmore,
Chennai 600008 Tamil Nadu, Tel : (044) 6518 3535,
Mob : 94440 01782 / 98450 21552 / 98805 82331,
Email : bharatsavla@yahoo.com

PREFACE TO THE SECOND EDITION

We are glad and excited to announce that the First Edition of this book received an overwhelming response from the engineering student community, compelling us to release its **Second Edition** within a very short period of time.

This thoroughly revised **Second Edition** has been updated with additional matter, many solved problems, including solutions to Numerous Exercises and University Question Papers (December 2013 to May 2017) for practice.

Special care has been taken to maintain high degree of accuracy in the theory and numericals throughout the book.

We take this opportunity to express our sincere thanks to Dineshbhai Furia of Nirali Prakashan, a reputed pioneer in the publication field. Our special thanks to Jignesh Furia for their effective cooperation and great care in bringing out this revised edition. We also appreciate the efforts of M. P. Munde and the entire staff of Engineering Books Deptt. of Nirali Prakashan namely Mrs. Deepali Lachake (Co-ordinator) for bringing this book to the students in a timely manner.

We sincerely hope that this "**Second Edition**" will also be warmly received by all concerned as in the past.

Valuable suggestions from our esteemed readers to improve the book are most welcome and highly appreciated.

Pune **Authors**

PREFACE TO THE FIRST EDITION

It gives us great pleasure in publishing this text book on **"Surveying"** for the Students of Second Year Degree Course in Civil Engineering. This book is strictly written According to New Revised Credit System Syllabus of Savitribai Phule Pune University (2015 Pattern).

As per the policy of the University, Engineering Syllabi is revised every five years. Last revision was in the year 2012. New revision is coming little earlier, as university has introduced **Online** system of examination from year 2012.

As per the New Credit System, the **In Sem (Online – 50 Marks) Examinations** (Combined Phase-I and Phase-II) will be conducted based on first, second, third and fourth units. The **Online** examinations will have objective types of questions with multiple choices. **End Semester Examination (Theory Paper 50 Marks)** will be based on all the six units and that will be conducted in traditional way and the theory course will have 4 credits.

One of the main concerns of Civil Engineer is survey work either in stage of planning or execution of different types of Civil Engineering Projects. He/she shall be well acquainted with the principles, concepts, facts and procedures in surveying. With this knowledge and skills, he/she will be able to develop or select and use appropriate techniques and instruments to establish controls, locate details, measure distances and directions, reduce positions, areas, volumes etc. during the survey for construction or maintenance or repair or extension of various civil engineering works in different roles.

The text book has been thoroughly prepared according to six units as per revised curriculum of 2015. An attempt is made to give due justice to the use of modern equipments in routine survey activities. The authors with their professional and academic experience have taken all efforts to present the text in lucid manner. The theoretical matter has been explained with number of diagrams and illustrations supported by solved examples. Questions from previous papers of the University of Pune are included at end of each chapter.

We have given Free Separate book of Multiple Choice Questions (MCQ's) which will be very useful to the students, especially for Online Examinations.

We take this opportunity to express our sincere thanks to Shri. Dineshbhai Furia, Shri. Jignesh Furia, MRs. Nirali Verma and Shri. M. P. Munde and entire team of Nirali Prakashan namely Mrs. Deepali Lachake (Co-ordinator) who really have taken keen interest and untiring efforts in publishing this text.

Finally, we express our gratitude to our family members for their continuous support and encouragement, thanks to all.

We have no doubt that like our earlier texts, student's community will respond favourably to this new venture.

The advice and suggestions of our esteemed readers to improve the text are most welcomed, and will be highly appreciated.

25th June 2016 **Authors**
Pune

SYLLABUS

Unit I : Compass and Plane Table Surveying (08 Hrs)

(a) Definition, objective and fundamental classification of surveying (Plane and Geodetic), concept of Scale, Ranging, Chaining, Offsetting and Traversing. Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction and correction for local attraction, dip, declination and calculation of true bearings.

(b) Equipment required for plane table surveying and their uses, advantages and disadvantages, methods of plane table survey: Radiation, intersection, traversing.

Unit II : Levelling and Contouring (08 Hrs)

(a) Introduction to leveling, Types of leveling, Types of bench marks, Study and use of dumpy level, auto level, digital level and laser level in construction industry, principle axes of dumpy level, testing and permanent adjustments, reciprocal leveling, curvature and refraction corrections, distance to the visible horizon.

(b) Contouring – direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, profile leveling and cross-sectioning and their applications.

Unit III : Theodolite Surveying (08 Hrs)

(a) Study of vernier transit 20" theodolite, uses of theodolite for measurement of horizontal angles by repetition and reiteration, vertical angles, measurement of deflection angles using transit theodolite and magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite.

(b) Theodolite traversing – Computation of consecutive and independent co-ordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gales traverse table. Checks, omitted measurements, area calculation by independent co-ordinates.

Unit IV : Tacheometry and Electronic Measurement Techniques (08 Hrs)

(a) Tacheometry – Application and limitations, principle of stadia tacheometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points, finding tacheometric constants. Tacheometric contouring.

(b) Surveying using Total Station – Study and use of Electronic Tacheometer (Total station) types, functions (remote elevation measurements, remote distance measurements, area measurement).

Unit V : Curves (08 Hrs)

Introduction to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. Angular methods: Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves and compound curves to be asked), Transition curves: necessity and types.

Unit VI : Construction Survey and Space Based Positioning System (SBPS) (08 Hrs)

(a) Introduction to construction survey, establishing of horizontal and vertical controls, setting out of buildings, maintaining verticality of tall buildings, survey for open traverse (roadway, railways, drainage lines, water lines, canals).

(b) Introduction to SBPS, SBPS Systems GPS, GLONASS, Galileo, GAGAN, BeiDou and their features, Segments of SBPS (Space, Control and User), applications of SBPS in surveying.

CONTENTS

Unit I : Compass and Plane Table Surveying

Unit II : Levelling and Contouring

✠ ✠ ✠

Unit I : Compass and Plane Table Surveying

Chapter 1

COMPASS

1.1 INTRODUCTION

In the process of planning, design execution of any kind of the civil engineering project on land, we shall know shape, sizes, area, unevenness at the surface of that land and details of natural and man made features on that parcel of the land. To know these things about the land we require collecting some measurements of land in horizontal and vertical plane. Here the surveying becomes necessary to an engineer. Surveying is unavoidable almost in all kind of civil engineering projects. Every civil engineer shall know in details the process of surveying. Hence surveying is one of the main concerns of a civil engineer. This subject will acquaint the concerned about the principles, concepts, facts, and procedures in Surveying.

Definition of Surveying

Surveying is an art and science of making measurements on the surface of earth to determine relative position of the points in horizontal as well in vertical plane, in order to prepare maps, plan or sections.

Objectives of Surveying

- To find out horizontal or vertical distance between two points or places or objects.
- To find out direction of a line joining two points or places or objects.
- To determine relative positions of points or places or objects in horizontal plane.
- To prepare plan or map for the allotted area.
- To determine relative positions of points or places or objects in vertical plane.
- To prepare relief plan/map and the sections at given locations for the allotted area.
- To find out the area of field.
- To divide and re-divide piece of land.
- To define and redefine boundaries of piece of land.
- To work out volumes.

1.2 FUNDAMENTAL CLASSIFICATION OF SURVEYING

Based upon the consideration of the shape of the earth, surveying is fundamentally classified as :

1. Plane surveying
2. Geodetic surveying.

1. Plane Surveying

In plane surveying, the mean surface of the earth is considered as a plane and the spheroidal shape is neglected. The earth's surface is considered as a plane, the line connecting any two points as a straight line and the angles of polygons as plane angles. The degree of accuracy required in this type of surveying is comparatively low. As a rough estimate, American surveyors put the limit 250 km^2 for treating the survey as plane. Most of the civil engineering works are concerned only with a small portion of the earth which seems to be plane surface.

2. Geodetic Surveying

In Geodetic surveying the curvature of earth is taken into consideration while making measurements on the earth surface. Hence use of spherical trigonometry and highly refined instruments are needed. In Geodetic surveys distances measured are along the arc of great circle and the angles measured are spherical angles.

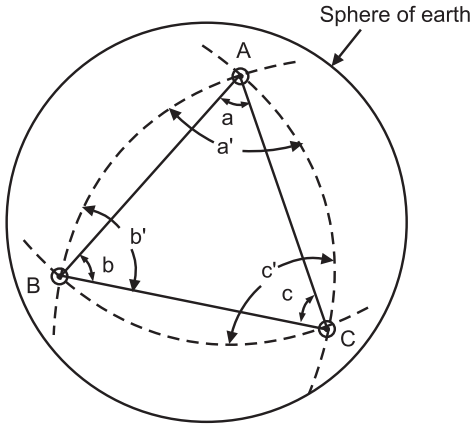


Fig. 1.1 : Plane and spherical triangles

ΔABC formed by straight and continuous lines is a plane triangle.

ΔABC formed by curved and dotted lines is a spherical triangle.

Straights AB, BC and CA are sides of the plane ΔABC.

Arcs AB, BC and CA are sides of the spherical ΔABC.

$\angle a$, $\angle b$ and $\angle c$ are the angles of the plane ΔABC.

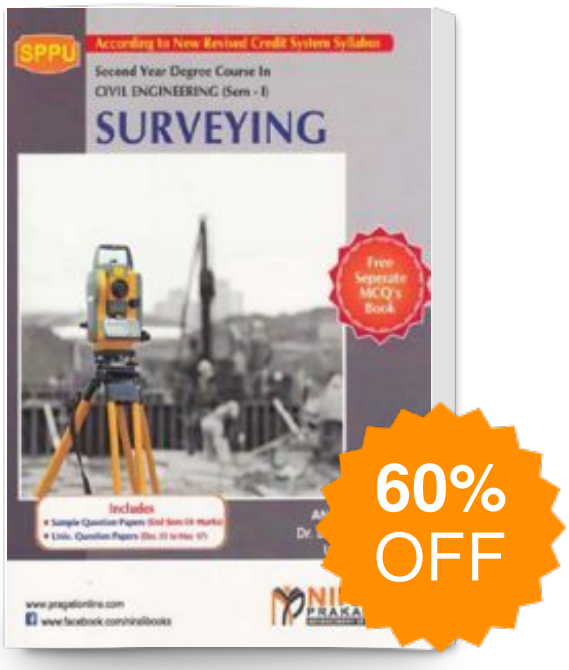
$\angle a'$, $\angle b'$ and $\angle c'$ are the angles of the spherical ΔABC.

It is observed that there is only a difference of 0.1 m in a length of arc and its corresponding chord on earth's surface in 18.2 km. The sum of angles of spherical triangle and its corresponding plane triangle differs only 1 second on the earth's surface over the area of 195.5 sq.km. Thus the American surveyors' suggest assuming the area to be surveyed as plane if its area is not likely to exceed 265.5 Sq. km. (10 miles x 10 miles).

The technique of Geodetic surveying is used to set up the network of the control stations over a wide spread area in multiples of 265.5 Sq. km, like that of a district or a state or a country. Triangulation and Trilateration are the principal methods of geodetic surveying.

Few Points of Differences between Geodetic Surveying and Plane Surveying are tabulated below.

A Text Book Of Surveying



Publisher : Nirali Prakashan ISBN : 9789386084040 Author : A. S. Shelar, Dr. S. T. Mali, U. S. Patil