SCHEME OF STUDIES

CERTIFICATE IN LAND SURVEYING

Sr.No.	Subjects	Theory	Practical	Sessional	Total Marks	Page Nos
1.	**CLS-101-Mathematics, Scales**	**70**	**0**	**0**	**70**	**2-3**
2.	**CLS-102-Introduction to Survey Instruments & their Use, Measurement of Vertical Distances**	**70**	**60**	**40**	**170**	**4-6**
3.	**CLS-103-Surveying , Field Astronomy & Curves**	**70**	**60**	**40**	**170**	**7-8**
4.	**CLS-104-Tacheometry, Plane tabling, Map Making**	**70**	**60**	**40**	**170**	**9-10**
5.	**CLS-105-Computations, Measurement & Errors** .	**70**	**0**	**0**	**70**	**11**
6.	**CLS-106-Photogrammetry, General Information on Surveying**	**70**	**0**	**0**	**70**	**12**
7	**CLS-107-Fundamentals of Microcomputers**	**30**	**0**	**0**	**30**	**13**
	TOTAL	**450**	**180**	**120**	**750**	

SCHEME OF STUDY FOR CERTIFICATE COURSE IN LAND SURVEYING

CLS-101-Mathematics, Scales

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	0	0	70	102

PART-I MATHEMATICS Marks-50

1. ARITHMETIC **Hours-12**

1.1. Decimal number system; operators in arithmetic; Vulgar and decimal fraction; Use of brackets and simplification.
1.2. Squares; Square root and Surds.
1.3. Average and calculation of means.
1.4. Unitary method of solution of problems.
1.5. Ratio and proportion; proportional divisions
1.6. Percentage.

2. **ALGEBRA.** **Hours-12**

2.1. Operations in algebra; Algebraic sentences and expressions.
2.2. Fundamental formula in algebra applicable in Surveying.
2.3. Square and Cube formula of (x-Y)
2.4. Simple fractions by using fundamental formula.
2.5. Ratio and proportions.

3. **GEOMETRY** **Hours-12**

3.1. Definition of point, straight line.
3.2. Definition of angle, acute angle, obtuse angle and right angle.
3.3. Definition of simple geometrical figures such as triangle, Equilateral triangle, Isosceles triangle, Quadrilateral Parallelogram, Rectangle, Rhombus, Square, Trapezium and polygon.
3.4. Calculation of areas of geometrical figures.
3.5. Sum of interior and exterior angles of geometrical figures.
3.6. Circles and tangents.
3.7. Arc, chords and segments.

4. **TRIGONOMETRY** **Hours-12**

4.1. Measurements of angles, Sexagesimal, Centesimal, and circular system; and their conversions.
4.2. Basic trigonometric functions and their relationship.
4.3. Inverse trigonometric functions.
4.4. Sin and cosine formula for triangles.
4.5. Solution of triangles.
4.6. Angles of elevations and depression; and simple problems in heights and distances.

5. **CO-ORDINATE GEOMETRY** **Hours-12**

5.1. Cartesian and polar coordinates and their plotting on graph paper.
5.2. Distance between two known points.
5.3. Straight line, its slope, equation and graph.
5.4. Area of triangle when coordinates of vertices are known.
5.5. Determination of coordinates of point of intersection of two straight lines.
5.6. Ellipse and Parabola, their definitions.

PART-II DRAWING AND SCALES Marks-20

1. DRAWING **Hours-18**

1.1 Demonstration and handling of Straight edge, Protractors, Parallel rules, Drawing pens, Dividers; spring-bow and other drawing instruments.

1.2 Drawing practice of lettering, line work, conventional signs; contours; hatchers; form lines; sand and water features etc.

1.3 Practice in fair drawing on blue prints.

2 SCALES **Hours-24**

2.1 Definition of Scale; Expression of scale; statement of scales; Representative function; plain scale; comparative scale; Diagonal construction of lines by using scales.

2.2 Enlarging and reducing by squares.

2.3 Limitations of scales and acceptable error in Dimension of maps.

2.4 Beam compasses; Graticule and its plotting construction of grid projection and plotting of coordinates of different scales.

2.5 Importance of scales in construction and use of maps.

Faculty Qualification

B.Sc (Mathematics)

BOOKS RECOMMENDED

i) Text book of mathematics for class IX & X, Punjab Text Board

ii) Surveying by PC Punmia.

CLS-102-Introduction to Survey Instruments & their Use, Measurement of Vertical Distances

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	60	40	170	102

PART-I MARKS-30

INRODUCTION OF SURVEY INSTRUMENTS AND THEIR USE

1. HORIZONTAL ANGLES Hours-12

1.1 Compass and its different parts; prismatic compass, names and functions of its different parts; procedures to use compass and termination of horizontal angles by using it.

1.2 Theodolite, its description and use, names and functions of its important parts, explanation of terms such as centering, face left, face right Horizontal Axis, Vertical axis, eye piece, object glass, line of collimation, Horizontal circle, Vertical circle, micrometer, the least count (orresolution), Focusing, parallax, Setting of Theodolote, Bisection, measurement of angles by methods of Repetition and reiteration; errors in angular measurements and precautions for accurate observations.

2 VERTICAL ANGLES Hours-12

2.1 The Indian Clinometer, its construction and principle on which its functioning is based; the measurement of angles of elevation and depression; accuracy of observation; and adjustments of clinometer.

2.2 Measurement of angles of elevation and depression by using theodolite; Errors in vertical angles and precautions in measuring the angles accurately; curvature and refraction correction.

3. DIRECTIONS Hours-12

3.1 Definition of true north and magnetic north; True or astronomic meridian; magnetic meridian; True or astronomic bearing; Magnetic bearing Assumed bearing and Magnetic declination.

3.2 Determination of magnetic bearing by using magnetic compass; uses and abuses of this bearing.

4.MEASUREMENT OF HORIZONTAL DISTANCES Hours-06

4.1 Chain, Tapes, Linen tape, steel tape, Invar tape, Ranging poles, Line ranger; Ranging of lines; measurement of distances; Errors in measurements; methods of chaining along sloping ground; and chaining over obstacles.

4.2 Substance Bar, its description and use, the principle on which its functioning is based; measurement of distance by using it; and advantage of using it.

5.ELECTRONIC DISTANCE MEASURING INSTRUMENTS Hours-06

Handling and operations of Electronic distances Measurement of Instruments (EDM); measurement of slope distances and their horizontal and vertical components; precautions in using EDMs; Precision and accuracy of measurements.

PART-II MARKS-40

MEASUREMENT OF VERTICAL DISTANCES

1. LEVELLING Hours-10

1.1 Definition of leveling and its objects.
1.2 Importance and uses of levelling.
1.3 Ordinary level machine and its construction, names and functions of its different parts; handling and operations of the machine.
1.4 Levelling rods and their use in levelling.
1.5 Definition and meaning of various terms such as level surface, level line, Horizontal plane, Vertical plane, Horizontal line, Vertical line, Datum surface, Mean sea level, elevation of point, Reduce level, Difference in elevation, Bench mark, Line of collimation, Axis of telescope, Axis of level tube, Horizontal axis, Vertical axis, Foresight, Back sight, Intermediate sight, Turning or change point, Height of instrument, Focusing, Parallax, Stadia wires, Shots and their balancing; and levelling equipment.

2.**Procedures of leveling Hours-9**

2.1 Procedures of levelling, different levelling methods, differential levelling, check levelling, Longitudinal levelling, cross levelling, and Reciprocal levelling.
2.2 Tertiary, Secondary and Precise levelling, High Precision levels and staves.
2.3 Recording of field observations and their computations.

3.Errors in Levelling Hours-17

3.1 Sources of errors in levelling and field procedures to avoid their effect;
Influence of curvature and refraction in levelling.
3.2 Collimation error and its adjustments.
3.3 Sensitive of level bubble and its determination.
3.4 Stadia constant and its determination.
3.5 Parallel plate micrometer and its function.
3.6 Gravity and its role in Surveying.

4 **TRIGONOMETRIC LEVELLING Hours-12**

4.1 Definition of horizontal distance and vertical angle.
4.2 Determination of heights by using clinometer and related diagram.
4.3 Determination of heights by using theodolite.
4.4 Errors in trigonometric levelling and the field procedures to avoid them.

5 LEVELLING BY OTHER EQUIPMENT Hours-06

5.1 Barometric levelling; the principle on which barometer is based to find elevation;
Advantage and disadvantages of barometer levelling.
5.2 Altimeter and its use in Surveying.

PRACTICAL

i) To determine difference of elevation between two points by using clinometer and clinopole.
ii) To measure difference of elevation between two points by using theodolite and measuring the in between distance.
iii) To find difference of elevation between two points by using level and levelling rods.
iv) To find difference of elevation of two distant points by running height traverse between them.
v) To find difference of elevation of two distant points by running a level line between the two points.
vi) To find difference of elevation of two points by using EDM equipment.

Faculty Qualification

B.Sc and Diploma in Land Surveying

BOOKS RECOMMENDED

i). Text book of surveying by Arora.
ii). Surveying by Bonnister.

CLS-103- Surveying, Field Astronomy, Curves

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	0	0	70	102

PART-I MARKS-40

SURVEYING

1. **GENERAL** **Hours-12**

1.1 Surveying and its primary divisions: plane Surveying and Geodetic surveying.

1.2 Principles of surveying: Location of a point by measurement from two points of reference; and working from whole to part.

1.3 Explanation of terms such as Control surveys, Horizontal control surveys, Vertical control surveys, Topographic survey, Cadastral survey, Route survey, Construction survey, Project survey, Hydrographic survey, Photogrammetric survey, Engineering Survey.

2. **THEODOLITE TRAVERSING** **Hours-18**

2.1 Definition of traverse; purpose and uses of theodolite traversing and the principle of traversing.

2.2 Making and description of traverse staqtion.

2.3 Bearings: Back bearing, Whole circle bearing, Reduce bearing, True bearing, convergency; and Grid bearing.

2.4 Kinds of traverse; Open traverse and Close traverse; Angular and Linear Checks in traversing and advantages and disadvantages of open and closed traverse.

2.5 Plotting of traverses: Angle and distance method; co-ordinate method.

3 TRIANGULATION **Hours-12**

3.1 Triangulations and its objects; Principles of triangulations; Base line; Triangulation figures; Well defined triangles; Centered figures and braced quadrilaterals; Selection of stations; Angular and linear checks in triangulations; Precautions for accurate field work; advantages and disadvantages of triangulation.

3.2 Resection: Its meaning and use in horizontal surveys.

4 TRILATERATION **Hours-12**

Trilateration and its objects; principles of trilateration; Figures in trilateration; errors and precautions.

PART-II MARKS-15

1.Field Astronomy **Hours-12**

1.1 Definition and explanation of terms; sphere, plane, small circle, Great circle, Spherical triangle, Angles and sides of spherical triangle, Earth, Axis of rotation, North pole, South pole, Celestial sphere,
Terrestrial equator, Celestial equator, Horizon, Zenith, Nadir, Terrestrial meridian, Celestial meridian, Vertical circle, Prime vertical, Latitude, co-latitude, Longitude, Altitude of celestial body, co-altitude or Zenith distance, Azimuth of celestial body, declination of celestial body, co-declination or polar distance, Right Ascension of a celestial body, Hour angle of celestial body, Circumpolar stars, Transit or Culmination, and elongation.

1.2 Solar time, sidereal time and connection between time and logitude. Universal time.

2.Determination of Azimuth **Hours-12**

2.1 Determination of azimuths by making observations on the sun or star and related computations.

2.2 Names and identifications of some major stars.

PART-III MARKS-15

1.SIMPLE CIRCULAR CURVES

1.1 Definition and meaning of terms: Setting out work; Curves, circular, parabolic, spiral; Classes of curves, Simple, Compound, reverse; Back tangent; Forward tangent; Point of intersection; point of curve; point of Tangency; Inspection angle; Deflection angle to any point.

1.2 Designation of curve; Relation between redius and degree of curve.

2.Setting out simple curves

2.1 Elements of simple curves and their values.

2.2 Setting out simple curves and their values. Using and importance of curve ranging.

Faculty Qualification

B.Sc and Diploma in Land Surveying

BOOKS RECOMMENDED

i). Surveying Vol-I & II by P.C. Punmia.
ii). Surveying by Bannister.

CLS-104- Techeometry Map Making, Fair Mapping

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	60	40	170	156

PART-I MARKS-10

1. **TECHEOMETRY AND TECHEOMETRIC INSTRUMENTS** **Hours-18**

1.1 Definition of Techeometry;the principles of techeometric measurement.

1.2 Use of Level and levelling rod & Clinometer and clino-pole as techeometric instruments to find horizontal and vertical distances; and accuracy of measurements.

PART-II MARKS-30

MAP MAKING

1. **DEFINITIONS OF TERMS** **Hours-12**

Map,plan, and chart: Details—natural and artificial; Topographic, Cadastral, Route, and Guide maps; Topographic maps; Large, Small, and Medium scale maps; scales and their limitations; Body, Edge, and Border of map.

2. **PLANE TABLE SURVEYING** **Hours-24**

2.1 Meaning of plane table surveying; Components of plane table sysytem; Accessories in plane table work; sight rule and its function in plane tabling.

2.2 Setting up the table; Orientation of table; System of plane tabling; Radiation, Traversing, Intersection; Resection, the point problem; Collin’s point solution of the problem; Bassel’s method for the solution of the problem; Trial and error method for the solution of the problem; Tracing paper method for resection in plane tabling; Strength of fix; Danger circle; Auxiliary points.

2.3 Plane table traverse and its graphical adjustment.

2.4 Sources of errors and precautions for accurate plane tabling work.

2.5 Advantage and disadvantages of plane table surveying.

3. **ACCESSORY WORK IN MAP MAKING** **Hours-12**

3.1 Colour trace: Items to be shown on it and objects of preparing and maintaining it in plane tabling work.

3.2 Height trace: Rules regarding preparation and maintenance of height trace in plane tabling work; items to be shown on it and purpose and objects of height trace.

3.3 P.T. traverse and methods to do it. Purpose of P.T traverse in plane tabling work.

3.4 List of control points, and box for inspection remarks.

3.5 Height book and its purpose.

3.6 Different tabular forms on the plane-table section.

4 CONTOURING **Hours-12**

4.1 Definition and measurement of contours, Contours line, Index Contour, Spot height, planimetric map, Hypsometric map, Relief Saddle, Slope, Tops, Watershed, and closed contours.

4.2 Properties of contours and contour intervals according to scale of the map.

4.3 Direct, Indirect, Use of level and staves and clinometers and clino-poles in contouring.

4.4 Interpolation of contour lines and uses of contoured maps.

PART-III MARKS-30

1. **FAIR MAPPING**

MAP PROJECTION **Hours-24**

1.1 Definition and measurement of Map Projection surfaces, cone and cylinder; Geometry of map projection; Equidistant, Equal area, and conformal projections.

1.2 Scale and scale Factor.

1.3 Convergency and Grid lines.

1.4 Dimensions of map; Graticule and plotting of control points

1.5 Enlargements and reduction of maps and their use and limitations.

2. **SPHERICAL AND GRID COORDINATES** **Hours-12**

2.1 Meaning and explanation of spherical and grid coordinates.

2.2 Grid letters-their use and purpose.

2.3 Spherical ticks on grided maps.

3. DRAWING MATERIAL **Hours-12**

Plane table sections; prints for mosaics; Blue prints, preparation of originals and guides.

4. FAIR DRAWING **Hours-24**

Cartographic methods and techniques; Inks and equipment; Lettering and conventional signs; Use of mapping pens; Crowquill pen, Ruling pen, Swivel pen and other drawing instruments.

5. SCRIBING **Hours-06**

Some ideas of scribing techniques and instruments used in these techniques.

PRACTICAL

Plan tabling on scale 1/1000, 1:10,000, 1;25,000, 1:50,000

Faculty Qualification

B.Sc and Diploma in Land Surveying

BOOKS RECOMMENDED

i). INTODUCTION TO SURVEYING
By James M. Enderson & Edward M. Mikhail.

ii). TEXT BOOK OF SURVEYING By P.B. Shahani.

CLS-105- Computations, Measurement & Errors

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	0	0	70	102

PART-I MARKS-50

1.Computations. **Hours-78**

1.1 Adjustment of observed angles of triangle and braced quadrilateral.
1.2 Adjustment of angles of open and closed traverses.
1.3 Computation of traverse and fits adjustment by Bowditch's method.
1.4 Calculation of curvature and refraction corrections.
1.5 Determination of bearing of a line of known ends.
1.6 Computation of length of a line of known ends.
1.7 Computation of true bearing, convergency and grid bearing.
1.8 Calculation of coordinates of the points intersected from three consecutive stations of a traverse line.
1.9 Determinations of dimensions of sheets of known graticules.
1.10 Calculation of area of figure on a map of known scale.
1.11 Conversions of spherical and grid coordinates of a point.
1.12 Calculation of scale factor at a point of known spherical coordinates.
1.13 Theodolite Resection its computations.

PART-II MARKS-20

2.MEASURING AND ERRORS **Hours-24**

2.1 Types of measurement in Surveying: Horizontal angles, Horizontal distances, vertical angles, vertical distances, and slope distances.
2.2 Units of measurement of length, angle; area and volume.
2.3 Significant Figures and rounding off Numbers.
2.4 Direct and Indirect measurements.
2.5 Errors in measurements:Mistakes,Sysematic errors, and random errors.
2.6 Sources of errors in making measurements.
2.7 Eliminating Mistakes and Systematic errors.

Faculty Qualification

B.Sc and Diploma in Land Surveying

BOOKS RECOMMENDED

i). INSTRUCTIONS TO PLANE TABLERS AND CHAPTER-V PLANETABLING published by SURVEY OF PAKISTAN.
ii). Chapter-III THEODOLITE TRANVERSING published by SURVEY OF PAKISTAN.
iii). Chapter-iv, TRIANGULATION published by SURVEY OF PAKISTAN.

CLS-106- Photogrammetry, General Information of Surveying.

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
70	0	0	70	85

PART-I MARKS-50

1.PHOTOGRAMMETRIC SURVEYS. Hours-68

1.1 Definition of photogrammetry.
1.2 Optics of Photogrammetry.
1.3 Types of Photographs.
1.4 Scale of Vertical Photograph.
1.5 How to cover an area with Photographs.
1.6 Aerial Cameras.
1.7 Difference between a vertical photo and a map.
1.8 Relief displacement.
1.9 Tilt displacement.
1.10 Identification on Photographs.
1.11 Stereoscopy.
1.12 Principles ofstero-photogrametry; orientation.
1.13 Stereoscopic plotting instruments.
1.14 Stereo mapping.

PART-II MARKS-20

2.General pieces of information on surveying and mapping. Hours-68

Some knowledge of the following: -

2.1 Sketch Surveys.
2.2 Completion surveys.
2.3 Verification Surveys.
2.4 Revision surveys.
2.5 Planimetric Surveys.
2.6 Hypsographic Surveys.
2.7 Altimetric Surveys.
2.8 Visual methods of up-dating old maps.
2.9 Thematic surveys and maps.
2.10 Geological surveys and maps.
2.11 Satellite positioning surveys.
2.12 Hydrographic Surveying.
2.13 Cadastral Surveying.

Faculty Qualification

B.Sc and Diploma in Land Surveying

BOOKS RECOMMENDED

i). Elements of Photogrammetry by Raul R. Wolf.
ii) Text Book of Photogrammetry by K.K. Ranpal
iii).Surveying by P.B. Shahani.

CLS-107- **Fundamental of Microcomputers.**

Theory Marks	Practical Marks	Sessional Marks	Total Marks	Total Hours
30	0	0	30	30

1. Fundamental of Computers

1.1 Introduction.
1.2 History of Computers
1.3 Generation of Computers
1.4 Types & Classification of Computers.
1.5 Hardware and software.
1.6 Operating Softwares
1.7 Application softwares
1.8 Storage Devices
1.9 Input/output Devices
1.10 Introduction to DOS
1.11 Introduction to Windows
1.12 Working with MS-Office

Faculty Qualification

B.Sc and Diploma in Computer Science

BOOKS RECOMMENDED

Computer fundamentals published by Pakistan Computer Bureau.