

Advanced Diploma in Land Surveying

TRAINING OBJECTIVES

Advanced Diploma in Land Surveying is a two year technical program devised to cope with rapid technology advancement in the field of Surveying & Mapping .The main objectives of this course are to provide, not only theoretical knowledge but in depth practical skill to students about basic and advanced technological concepts of Surveying and Mapping .The graduates of this program shall be equipped with strong theoretical based with sound practical knowledge of the subject.

CURRICULUM SALIENTS

Name of course	:	Advanced Diploma in Land Surveying
Entry level	:	B.Sc. with Mathematics
Duration of course	:	2 year (4 Semesters)
	:	3200 Hours
	:	(800 Hours per Semester)
Training contact hours per day	:	7 hrs. (Friday 5 hrs.)
Training hours per week	:	40-hrs
Training methodology	:	Practical 75%
		Theory 25%
Medium of Instruction	:	English

SKILL PROFICIENCY DETAILS

On the successful completion of the course, the trainee will have following skills:

- Prepare maps using Plane Table and Total station.
- Digitize map in ArcGIS and AutoCAD.
- Compute and adjust the traverse line, triangulation and level lines.
- Interpret the aerial photographs and satellite images.
- Prepare the originals and guides, scales and projection of mapping.
- Select appropriate scale and contour interval for various types of maps and surveys.
- To develop computer programs to be used in surveying.
- To export/import and process digital data of GPS and Total Station.
- Scanning and printing of maps.
- Time & Cost estimation of Surveying and Mapping projects.

KNOWLEDGE COMPETENCY DETAILS:

On the successful completion of course, the trainee shall be able to

- Work according to the rules and regulations of surveying and mapping ethics.
- Working knowledge of different surveying instruments including Total Station, GPS and Work Stations.
- Execution of Control Survey, Topographic Survey on different scales.
- Computations and adjustments involve control survey.
- Map preparation and interpretation using prescribed symbols.
- Knowledge of basic geodesy and map projections.
- Fundamentals of computers and programming.
- Able to work with ArcGIS and AutoCAD for map digitization.
- Theoretical knowledge of Photogrametric procedures.
- Handle, store, recover and backup of digital databases.
- Statistical analysis of data.
- Digital image processing techniques.

CURRICULUM DELIVERY STRUCTURE

1ST SEMESTER

	Curriculum Delivery	Co-curricular activities/vacations	Test	Total
Week	1-20	21 - 25	26	26
	20	5	1	

2nd SEMESTER

	Curriculum Delivery	Co-curricular activities/vacations	Test	Total
Week	1-20	21 - 25	26	26
	20	5	1	

3rd SEMESTER

	Curriculum Delivery	Co-curricular activities/vacations	Test	Total
Week	1-20	21 - 25	26	26
	20	5	1	

4th SEMESTER

	Curriculum Delivery	Co-curricular activities/vacations	Test	Total
Week	1-20	21 - 25	26	26
	20	5	1	

SCHEME OF STUDIES
ADVANCED DIPLOMA IN LAND SURVEY
(2 Year Course)
SEMESTER - I

Code No.	Subjects	Theory (hrs)	Practical (hrs)	Total Hours
SS111	Surveying-I	40	180	220
MT112	Mathematics-I (A + B)	60	0	60
IT113	Introduction to Computer and Programming	40	60	100
SS114	Technical Drawings and Drafting	40	180	220
SS115	Geodesy-I	40	60	100
SS116	Database Design	40	60	100
Total		260	540	800

SEMESTER - II

Code No.	Subjects	Theory (hrs)	Practical (hrs)	Total Hours
SS121	Surveying-II	40	180	220
MT122	Mathematics-II	40	0	40
SS123	Photogrammetry-I	40	180	220
SS124	Cartography	40	120	160
SS125	Survey Computation (A + B)	60	0	60
SS126	RS and Image Processing	40	60	100
Total		260	540	800

SEMESTER - III

Code No.	Subjects	Theory (hrs)	Practical (hrs)	Total Hours
SS211	Surveying-III	40	720	760
SS212	Map Projections	40	0	40
Total		80	720	800

SEMESTER - IV

Code No.	Subjects	Theory (hrs)	Practical (hrs)	Total Hours
SS221	Geodesy-II (A + B)	60	120	180
SS222	Construction Surveying	40	120	160
PP223	Project Planning & Cost Estimation	40	0	40
SS224	Photogrammetry-II	40	120	160
SS225	Geographic Information System(GIS)	40	180	220
SS226	Communication and Interpersonal Skills	40	0	40

1ST SEMESTER

Sr.No.	Detail of Topics	Theory Hours	Practical Hours
1	SS-111 Surveying-I	40	180
	1.1 Introduction and History		
	1.1.1 Introduction to surveying, History of surveying, Principles of surveying	3	
	1.1.2 Primary divisions, Plane and geodetic surveying with examples, Absolute and relative positions	2	
	1.1.3 Explanation of terms such as control surveys, horizontal surveys, vertical surveys ,geodetic surveys, topographical surveys, cadastral surveys, route surveys, construction surveys, project surveys, engineering surveys photogrammetric surveys, hydrographic survey	2	
	1.2 Surveying Instruments		26
	1.2.1 Chain and tapes, Level and staff	2	
	1.2.2 Clinometers ,Theodolites	2	
	1.2.3 Total station, Global Positioning System (GPS)	2	
	1.3 Distance Measurement		26
	1.3.1 Methods of distance measurement, Tape and chain	2	
	1.3.2 Tachometry	2	
	1.3.3 Electronic distance measurement	2	
	1.3.4 Errors in measurement of distance and corrections, Miscellaneous problems in measuring distance	2	
	1.4 Height Measurements		64
	1.4.1 Leveling and its objectives, Ordinary level and its construction different levels and staves, Sources of error in leveling, Definition of various terms	2	
	1.4.2 Methods of leveling, Types of leveling	2	
	1.4.3 Computation of Level line and Adjustment of a network heights.	2	
	1.5 Angle and Direction Measurement		32
	1.5.1 Measurement of horizontal angles, Interior angles, Deflection angles, Meridians, Bearings & azimuth ,Magnetic declination, Variations in magnetic declination	2	

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	1.5.2	Methods of determining angles and directions using tape, magnetic compass, theodolite and total station	2	
	1.5.3	Vertical angle and its measurement by using theodolite and clinometer, Errors in angular measurements and precautions for accurate observations	2	
	1.6 Tachometry			32
	1.6.1	Meaning and explanation of tachometric surveying, Instruments used in tachometry, uses of tachometry	2	
	1.6.2	Principles of tachometry, Stadia system and the tangential system used in the tachometric surveying	2	
	1.6.3	Importance field notes in tachometric surveying its completeness and legibility	1	
	1.6.4	Types and styles of notes tabulations sketches description and combinations	1	
	1.6.5	Use of clinopole, level and staff as tachometric instruments in plane tabling, Advantages and disadvantages of tachometric surveying	1	
2	MT-112-Mathematics-I A		30	-
	2.1. Plane Trigonometry			
	2.1.1	Measurement of angles, Sexagesimal, centesimal measures and their conversions	3	
	2.1.2	Trigonometrical ratios and their relationship	5	
	2.1.3	Transformation of products and sums	3	
	2.1.4	Double angle formulae, half angle formulae, Inverse Trigonometrical functions	5	
	2.1.5	Heights and distances.	5	
	2.2. Logarithms			
	2.2.1	Basic rules	3	
	2.2.2	Common and natural logarithms, Characteristics and mantissa	3	
	2.2.3	Antilogarithm, application of logarithms.	3	
3	MT-112-Mathematics-I B		30	-
	3.1. Algebra			
	3.1.1	System of linear equations, Simultaneous equations	5	
	3.1.2	Binomial theorem for any index	3	
	3.1.3	Matrices, Equality and sums of matrices, Scalar and matrix multiplication, Transpose and inverse of a matrix	3	

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	3.1.4 Determinants, minors and co-factors, adjoint matrices, Matrix inversion.	3	
	3.2. Plane Analytical Geometry		
	3.2.1 Cartesian and polar coordinates	4	
	3.2.2 The straight line, Equation of straight line	4	
	3.2.3 Change and rotation of axes	4	
	3.2.4 Circle, parabola, ellipse and their equations.	4	
4	IT-113 Introduction to Computer and Programming	40	60
	4.1. Introduction to Computers		16
	4.1.1 Introduction to numbers systems, CPU, Memory, Input/output devices, Data organization, File storage	2	
	4.1.2 Programs and software, Operating systems ,System and application software,	2	
	4.1.3 Communication technology, Compiler DBMS	2	
	4.1.4 Computer networks and internet, WWW web mail applications, Viruses and Anti-Viruses, Accounting procedure	2	
	4.2. Programming		32
	4.2.1 Introduction to programming and Visual basic	4	
	4.2.2 Fundamental of programming in visual basic	6	
	4.2.3 Controlling programme flow, Arrays	10	
	4.2.4 Additional feature of Visual Basic.	6	
	4.3. Computer programs in surveying		12
	4.3.1 Executing and debugging programs for different surveying techniques.	6	
5	SS-114 Technical Drawings & Drafting	40	180
	5.1. Introduction to engineering drawing/map		20
	5.1.1 Importance of Engineering drawing, types of drawing, drawing tools and instruments, drawing sheet	2	
	5.1.2 Concept of lines, types of lines, selection of pencil, title strip and title blocks.	2	
	5.1.3 Geometrical drawing, angles, triangles, quadrilaterals, polygons, circle	2	
	5.2 Scale		80
	5.2.1 Linear and diagonal scales ,Plain scale, Limitation of scale and acceptable error of map dimensions	3	
	5.2.2 Beam compass, Drawing of graticule, grids	2	

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	5.2.3 Construction of grid projection and plotting of coordinates on different scales	3	
	5.2.4 Importance of scales in construction and use of maps	3	
	5.3 Orthographic projection	2	20
6	5.3.1 Parallel and central projections, rules to draw orthographical projections	2	60
	5.4 AutoCAD		
	5.4.1 Introduction to AutoCAD , drawing and editing tools	11	
	5.4.2 Drawing of 2D figures	4	
	5.4.3 Drawing views of 3D solids	4	
	SS-115 Geodesy-I	40	60
	6.1. Basic Concepts of Geodesy		
	6.1.1 Definition of geodesy, Topographical surface and its unevenness	3	
	6.1.2 Geoids, Spheroid ,Orthodrome, Loxodrome	3	
	6.1.3 Definition and notations on the ellipsoid and sphere	3	
	6.1.4 Radius of curvature along the prime vertical and along the meridian planes of the reference spheroid	3	
	6.2. Precision Leveling and Heights		30
	6.2.1 Precise leveling, Precise invar levels and leveling staves, Bench marks	2	
	6.2.2 Methods for accurate measurement	3	
	6.2.3 Orthometric heights & Dynamic heights, Uses and importance of geodetic leveling.	2	
	6.3. Measurement of Angles and Distances		
	6.3.1 Traverse, Triangulation and trilateration, Theodolite observations, Station adjustment, Acceptable accuracy of geodetic triangulation, Trilateration, Traverse	2	
6.3.2 Signals, Station marks, Observation towers, Triangulation chains, Selection of strong triangulation figures	2		
6.3.3 Reconnaissance, observational precautions, Auxiliary stations ,refractive index, Ground swing	3		
6.4. Geodetic Astronomy		30	

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	6.4.1	Definition of basic terms: earth axis and rotation, north pole, south pole, celestial sphere, the terrestrial equator, celestial, equator horizon, zenith, nadir, terrestrial meridian, celestial meridian, vertical circle, prime vertical, latitude, longitude,	3	
	6.4.2	Astronomical triangle, Latitude, longitude, Longitude differences, Time chronometer and chronograph ,Chronometer error, Local sidereal time	3	
	6.4.3	Basic observations, Altitude of stars. Refraction angle, Azimuth by altitude and hour angle method, Calculation of azimuth by altitude, Recording of time of observation, Time signals, Stopwatch	3	
	6.4.4	Star observation programme, Latitude and azimuth observation and computation ,Observing the sun, The suns right ascension, Equal altitude method	3	
	6.4.5	Effects of errors in astronomical work, Error in azimuth and accuracy	2	
7	SS-116 Database Designs		40	60
	7.1.1	Basic database concepts; Entity Relationship modeling, Relational data model and algebra	7	
	7.1.2	Structured Query language, RDBMS; Database design	7	
	7.1.3	Functional dependencies and normal forms,	7	
	7.1.4	Transaction Processing and optimization concepts;	7	
	7.1.5	Concurrency control and recovery techniques, Database recovery techniques	6	
	7.1.6	Database security and authorization Small Group Project implementing a database	6	
		Total	260	540

Second Semester

Sr.No.	Detail of Topics	Theory Hours	Practical Hours
	<p>SS 121 Surveying II</p> <p>1.2. Traversing</p> <p>1.2.1 Definition of traverse, Purpose of theodolite traverse and the procedure of traversing, Bearings</p> <p>1.2.2 Kinds of traverse, Advantages and disadvantages of open and closed traverses, Angular and linear checks in traversing</p> <p>1.2.3 Plotting of traverse by angle and distance method, Coordinate method</p> <p>1.2.4 Adjustment of angular errors , bearings and Closing errors by Bowditch’s method</p> <p>1.2.5 Precautions in field observations for achieving the desired accuracy</p> <p>1.3. Triangulation and Trilateration</p> <p>1.3.1 Triangulation and its objectives, Principles of triangulation, Advantages and disadvantages of triangulation, Base line, Triangulation figures, Well defined triangles, Centered polygons and braced quadrilaterals</p> <p>1.3.2 Selection of stations, Indivisibility of stations, Grazing ray and signals, Monumentation, towers</p> <p>1.3.3 Angular and liner checks in triangulation, Precautions for accurate field work, Reconnaissance & its importance</p> <p>1.3.4 Intersection, resection and their application in horizontal surveys</p> <p>1.3.5 Triangulation computation and adjustment on plain paper</p> <p>1.3.6 Meaning and explanation of trilateration,</p>	<p>40</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>2</p>	<p>180</p> <p>60</p> <p>52</p>

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	Figures in trilateration, Errors precautions and limitations, Adjustment of trilateration		
	1.4. GPS		68
	1.4.1 Introduction to GPS, Types of GPS, Principle of working of GPS, segments of GPS, GDOP, errors in GPS	4	
	1.4.2 Observation techniques	4	
	1.4.3 Downloading/processing of GPS data	4	
2	MT-122 Mathematics-II	40	-
	2.1. Calculus		
	2.1.1 Taylor's and Maclaurin series	3	
	2.1.2 Functions of two variables	3	
	2.1.3 Differentiation of algebraic	3	
	2.1.4 Trigonometric and rational functions and their integration	3	
	2.1.5 Partial differentiation	3	
	2.1.6 Maxima and minima, Point of inflection	3	
	2.2. Spherical Trigonometry		
	2.2.1 Great and small circles	2	
	2.2.2 Spherical triangles, Solution of spherical triangle	3	
	2.2.3 Area of a spherical triangle and spherical excess.	3	
	2.3 Solid Analytical Geometry		
	2.3.1 Coordinates, Various coordinate systems used in 3-dimension	4	
	2.3.2 Change of axes, Rotation and translation of axis, Transformation of coordinates	4	
	2.3.3 Sphere, cone ,cylinder and their equations	3	
	2.3.4 Ellipsoid and spheroid	3	
3	SS-123 Photogrammetry-I	40	180
	3.1. Basic Concepts		84
	3.1.1 Definition and History of Photogrammetry, Photogrammetric instruments	3	
	3.1.2 Classification of stereoscopic plotters	3	
	3.1.3 DPWs, Components of DPW	3	
	3.1.4 Software and their utilities	3	
	3.1.5 Types of aerial cameras, Main parts of aerial camera, Focal plane and fiducial marks	3	

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	3.1.6	Types of photographs, Geometry, Scale of vertical photograph	2	
	3.1.7	Photo scale, Methods of determining scale of vertical photographs	2	
	3.1.8	Relief displacement, Flying height, Mission planning	2	
	3.1.9	Calculation of number of strips and photographs	2	
	3.2. Stereoscopic Viewing			96
	3.2.1	Depth perception, Human eye, Stereoscopic depth perception	3	
	3.2.2	Viewing photographs stereoscopically	3	
	3.2.3	Object recognition stereoscopes & its uses	3	
	3.2.4	Stereoscopic parallax ,Causes of y-parallax	3	
	3.2.5	Vertical exaggeration	2	
	3.2.6	Photographic flight line axis for parallax measurement, Monoscopic & stereoscopic parallax measurement.	3	
4	SS-124 Cartography		40	120
	4.1. Introduction			
	4.1.1	Scope of cartography, Theoretical principles of cartography, Technical advances in cartography	4	
	4.1.2	Classes of maps, Basic characteristics of maps Map types & Map use. Map scales	4	
	4.1.3	International numbering system	4	
	4.1.4	Methods of orientation of a map on the ground	4	
	4.2. Map Design			120
	4.2.1	Symbology	6	
	4.2.2	Color scheme of maps, Size of map, Color separation in printing	6	
	4.2.3	Marginal information, Placement of various details in the map	12	
5	SS-125 Survey Computation-A		30	-
	5.1. Sources of Inaccuracies			
	5.1.1	Concept of measurement and error, Types of errors	2	
	5.1.2	Reliability of measurements, Accuracy and precision of measurements, Significant figures	2	

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	5.1.3 Error propagation, Linearization	2	
	5.2. Concept of Adjustment		
	5.2.1 Simple adjustment methods, The least squares method, Techniques of least squares, The concept of weight	3	
	5.2.2 Least squares adjustment of indirect observations, Least squares adjustment of observations only	3	
	5.3. Elementary Probability Theory		
	5.3.1 Random events and probability, Random variables	2	
	5.3.2 Continuous probability distributions, Normal distribution	2	
	5.3.3 Expectation, Measures of precision and accuracy	2	
	5.3.4 Covariance and correlation, Cofactor and weight matrices, Introduction to sampling	2	
	5.4. Variance-Covariance Propagation		
	5.4.1 Introduction, Derivation of the propagation laws, Stepwise propagation, Propagation for least squares	2	
	5.4.2 Propagation for least squares adjustment of observations only, Adjustment of indirect observations	2	
	5.5. Pre-analysis of Survey Measurements		
	5.5.1 Pre-analysis procedure, Horizontal angle measurement with a theodolite, Distance measurement by EDM	3	
	5.5.2 Elevation difference by direct leveling and Survey tolerances	3	
6	SS-125 Survey Computation-B	30	-
	6.1. Introductory Statistical Analysis		
	6.1.1 Samples and Statistics, The chi-square distribution, The (student) distribution common sample statistics	2	
	6.1.2 Estimation of the mean, variance, Confidence interval for the mean, variance	2	
	6.1.3 Statistical testing test of the mean of probability distribution, Test of the variance of a probability distribution, Bivariate normal distribution	2	

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	6.1.4 Error ellipses applications in Plane Coordinate Surveys, Position fixing by distance	2	
	6.1.5 Distance condition and its linearization, The azimuth condition and its linearization	2	
	6.1.6 Two-parameter similarity transformation, Four-parameter similarity transformation	2	
7	6.2. Instrument's checking and Calibration		
	6.2.1 General equipment abuse	4	
	6.2.2 Instrument's adjustment and repair	6	
	6.2.3 Calibrations, Practical use and application of a calibrated baseline.	8	
	SS-126 Remote Sensing and Image Processing	40	60
	7.1. Remote Sensing		
	7.1.1 Definition and History, Concepts and principles of remote sensing, Components of remote sensing	4	
	7.1.2 Physical basis (em spectrum energy interaction spectral reflectance curves image characteristics), Sensor systems,	4	
	7.1.3 Platforms (Types and Orbital Characteristics), Scanners	4	
	7.1.4 Electro optical sensors, Radar satellite characteristics, Orbits and swaths	4	
	7.2. Digital Image Processing		60
	Data Formats (BSQ BIL BIP etc.), Image Sub setting	4	
	7.2.1		
7.2.2 Enhancement techniques, Filters	4		
Image Mosaicing and Color Balancing, Image rectification	5		
7.2.3			
7.2.4 Image classification	6		
7.2.5 Registration and Re-sampling	5		
	Total	260	540

3rd Semester

Sr.No.	Detail of Topics	Theory Hours	Practical Hours
1	SS-211 Surveying-III	40	720
	1.1. Topographic survey using Plane Table		576
	1.1.1 Introduction, Advantages and disadvantages of plane table surveying, Components of plane table and its accessories, Sources of error and precautions for accurate plane tabling work, Orientation of plane table	3	
	1.1.2 Radiation ,traversing, intersection and resection methods of plane tabling on scale 1:1,000, 1:10,000, 1:50,000	3	
	1.1.2 Auxiliary points ,three point problem, Danger circle,	4	
	1.1.4 Use of plane table surveying in horizontal surveys for traversing, triangulation and trilateration	2	
	1.1.5 Color trace and height trace, List of control points, height book, name list	2	
	1.1.6 Contours & contouring, Characteristics and properties of contours, Direct and indirect method of contour, Trace contour method, Interpolation of contour lines , uses of contour maps	4	
	1.2. Topographic survey using Total Station		144
	1.2.1 Basics of Total Station, Types of Total Station, Advantages and disadvantages of Total Station	2	
	1.2.2 Fundamental parameters of Total Station, Feature codes and attributes	4	
	1.2.3 Data collection procedures	8	
	1.2.4 Data down loading/processing.	8	
2	SS-212 Map Projections	40	-
	2.1. 2.1.1 Basic concepts of map projections	2	
	2.1.2 Purposes and methods of projections	6	
	2.1.3 Classification of map projections and their properties	8	

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	2.1.4	Mathematical derivation of elements of the Lambert conformal conical projection with one and two standard parallels	8	
	2.1.5	Universal Transverse Mercator (UTM) projection system, Projection parameters	8	
	2.1.6	Datum, Datum transformation, Transformation parameters	8	
Total			80	720

4th Semester

Sr.No.	Detail of Topics	Theory Hours	Practical Hours
1	SS-221 Geodesy-II A	30	120
	1.1. Geodetic Computations		
	1.1.1 Reference surface, Spherical excess,	3	
	1.1.2 Ellipse geometry, Spheroid geometry, Spheroid coordinates	6	
	1.1.3 Reduction of angular and distance observation to geoid/spheroid surface and related computation	6	
	1.1.4 Clarke's formulae for determining geodetic position	6	
	1.1.5 Computing in 3d coordinates	3	
	1.1.6 Inverse computations and plane coordinates.	6	
2	SS-221 Geodesy-II B	30	
	2.1. Satellite Surveying		
	2.1.1 Concepts of satellite surveying, The principles of satellite orbits	2	
	2.1.2 Different techniques of satellite surveying, Point positioning and relative positioning (translocation),	2	
	2.1.3 Precise and broadcast ephemeris, Geodetic and Cartesian coordinates	2	
	2.1.4 Datum transformation and its types, Two-dimensional transformations, Three dimensional transformation parameters and the seven transformation	4	
	2.1.5 Datum shift parameters for locally adopted reference ellipsoid	3	
	2.2. Gravimetric Survey		120
	2.2.1 What is gravity its direction and value, Field of gravity and definition of related terms,	3	

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	2.2.2	Deviation of the vertical and its determination	3	
	2.2.3	Gravity anomalies, Gravity surveys network, Global gravity reference system	3	
	2.2.4	Gravity instruments, Absolute and relative gravity measurement, Formulae for corrections	3	
	2.2.5	Reduction of observations and computation	3	
	2.2.6	Use of gravity observation in precise leveling for conversion of dynamic heights to orthometric heights	2	
3	SS-222 Construction Survey		40	120
	3.1.	Setting out Works		24
	3.1.1	Basic principles and point marking	2	
	3.1.2	Horizontal control, Vertical control	2	
	3.1.3	Vertical alignment, Connection of surface and underground lines	2	
	3.2.	Highway Curves		32
	3.2.1	Route survey, Circular curves and geometry, Deflection and chord calculations	3	
	3.2.2	Field procedure for setting out highway curve	3	
	3.2.3	Introduction to compound reverse and vertical curves	3	
	3.2.4	Introduction to super elevation curve design	3	
	3.3.	Highway /road design		32
	3.3.1	Definition of basic highway design terms	2	
	3.3.2	Placement of slope stakes, Layout for line and grade	2	
	3.3.3	Road cross sections, Plan and profile	3	
	3.3.4	Offset lines and construction control, Site grading	2	
	3.4.	Pipeline and Tunnel Construction		
	3.4.1	Pipeline construction, Sewer construction, Tunnel construction	2	
	3.4.2	Layout for line and grade, Catch basin construction layout	2	
	3.5.	Culvert and Bridge Construction		

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	<p>3.5.1 Culvert and bridge construction, Contract drawing, Layout computations, Offset distance computations</p> <p>3.5.2 Dimension verification, Cross sections for footing excavations</p> <p>3.6. Area and Volume</p> <p>3.6.1 Area computation, Area by graphical analysis, Construction volumes, End areas and volumes</p> <p>3.6.2 Volume computation by geometric formula, Cross sections, Borrow pit.</p>	<p>2</p> <p>2</p> <p>3</p> <p>2</p>	<p>32</p>
4	<p>PP-223 Project Planning & Cost Estimation</p> <p>4.1. Project Planning and Cost Estimation</p> <p>4.1.1 Introduction to project planning, project goals and objective, project deliverables, project milestones, activities and tasks, estimating time and cost.</p> <p>4.1.2 Specification and data, Field work involved</p> <p>4.1.3 Expected out turn, Man power available</p> <p>4.1.4 Field work, Office work (drawing and compilation)</p> <p>4.1.5 Composition of squad for each activity, Average emoluments of personnel employed for field /office work</p> <p>Contingent expenditures, Supervision charges, Overhead charges</p> <p>4.2. Accounts and Administration</p> <p>4.2.1 Organization of Survey of Pakistan, directorate and a unit ,Disciplinary rules, appeal rules ,seniority rules</p> <p>4.2.2 D.D.O, Authority and their role ,Controlling officer authorized officer, Gazetted and non-gazetted officers, Selection grade criteria</p>	<p>40</p> <p>5</p> <p>5</p> <p>5</p> <p>5</p> <p>6</p> <p>8</p> <p>3</p> <p>3</p>	<p>-</p>
5	<p>SS-224 Photogrammetry-II</p> <p>5.1. Aerial Triangulation(AT)</p> <p>5.1.1 Method and purpose of AT, Types of AT ,Software used in AT</p> <p>5.1.2 Block and Bundle adjustments, Selecting photo control images</p> <p>5.1.3 Number location and marking of photo control</p> <p>5.1.4 Coordinate system for horizontal control, Field methods for establishing horizontal and vertical control.</p>	<p>40</p> <p>5</p> <p>5</p> <p>6</p>	<p>120</p> <p>40</p>

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	<p>5.2. Digital Mapping</p> <p>5.2.1 Learning handling of DPW, Preparation of project</p> <p>5.2.2 Development of stereo models, DEM generation</p> <p>5.2.3 Orthophoto, Feature extraction from stereo model, Orthophoto map</p> <p>5.2.4 Contouring (auto, semi-auto), Advantages and disadvantages and uses of orthophoto maps</p>	<p>6</p> <p>6</p> <p>6</p> <p>6</p>	<p>80</p>
6	<p>SS-225- Geographic Information System (GIS)</p> <p>6.1. Introduction to Geographic Information System (GIS)</p> <p>6.1.1 What is GIS, Evolution of GIS, Application of GIS, Classification of GIS, Components of GIS</p> <p>6.1.2 Geo-referenced data in GIS, Contributing disciplines & technologies of GIS</p> <p>6.2. Key Components</p> <p>6.2.1 GIS hardware consideration, Input devices ,storage devices ,output devices, Capabilities of GIS software</p> <p>6.2.2 Profile of some GIS software's e.g. Arc info map info arc view & AutoCAD map etc, Database and database management system</p> <p>6.3 GIS Data Models</p> <p>6.3.1 Raster Data Model, Vector data Model</p> <p>6.3.2 Uses and benefits of these data models, Comparison between raster & vector data</p> <p>6.4. Data Layers colors and Symbology</p> <p>6.4.1 Vector data layers, layer structure, Raster data structure</p> <p>6.4.2 Attribute data, data quality ,meta data</p> <p>6.5. Data Sources & Capturing Techniques</p> <p>6.5.1 Scanning maps, Digitizing</p> <p>6.5.2 Use of aerial photography ,Satellite data, GPS data</p> <p>6.5.3 Field data and attribute data, Georeferencing and Transformation of data</p>	<p>40</p> <p>3</p> <p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p> <p>3</p>	<p>180</p> <p>4</p> <p>10</p> <p>16</p> <p>20</p> <p>80</p>

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	<p>6.5.4 Digitizing errors, Topological Errors, Errors in base data, Scanning errors ,Plotting errors</p> <p>6.6. Data Visualization</p> <p>6.6.1 Adding/creating symbology</p> <p>6.6.2 Labeling features, Querying data, Reprocessing</p> <p>6.6.3 Editing features and attribute values</p> <p>6.6.4 Map lay-out / printing</p>	<p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>2</p>	<p>50</p>
7	<p>GE-226 Communication Skills and Report Writing</p> <p>7.1. 7.1.1 Principles of writing good English, Understanding the composition process: writing clearly; words sentence and paragraphs.</p> <p>7.1.2 Comprehension and expression use of grammar and punctuation, Process of writing observing audience analyzing collecting composing drafting and revising</p> <p>7.1.3 Persuasive writing, Reading skills ,Listening skills and comprehension, Skills for taking notes in class, Skills for exams</p> <p>7.1.4 Business communications, Planning messages, Writing concise but with impact Letter formats</p> <p>7.1.5 Mechanics of business, Memo and applications</p> <p>7.1.6 Letter writing, Summaries ,Proposals, Writing resumes ,Styles and formats,</p> <p>7.1.7 Oral communications, Verbal and non-verbal communication ,Conducting meetings ,Small group communication ,Taking minutes</p> <p>7.1.8 Scope and audience of the presentation</p> <p>7.1.9 Material gathering, Material organization strategies, Time management</p> <p>7.1.10 Opening and concluding, Use of audio-visual aids, Delivery and presentation</p>	<p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>4</p> <p>5</p> <p>3</p>	<p>-</p>
Total		260	540

PRACTICALS

1st SEMESTER

Sr.No.	Detail of Topics	Practical Hours
1	SS-111 Surveying-I 1.2 Surveying Instruments 1.2.1 Practice to use chains , tapes and staves 1.2.2 Demonstration of the following instruments: Clinometer ,Theodolite, Total station and Global Positioning System (GPS) 1.3 Distance Measurement 1.3.1 Measuring horizontal distance by tape and chain 1.3.2 Measuring horizontal and vertical distance by theodolite. 1.3.3 Measuring horizontal and vertical distance by Total Station. 1.4 Height Measurements 1.4.1 Setting up the level and methods of reading level staves and their recording in the field book. 1.4.2 Running of a single tertiary leveling line of about two kms between two bench marks. 1.4.3 Computation and adjustment of a single tertiary leveling line and determination of reduced levels. 1.5 Angle and Direction Measurement 1.5.1 Measuring horizontal angle by tape, compass, theodolite and total station. and vertical angle by clinometer, theodolite and total station. 1.6 Tachometry 1.6.1 Determining stadia constant of a level machine and theodolite 1.6.2 Practice to measure horizontal and vertical distance by stadia and the tangential methods.	180 10 16 8 10 8 16 32 16 32 16 16
2	IT-113 Introduction to Computer and	60

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	Programming 2.1. Introduction to Computers 2.1.1 Recognition of hardware components and their slots plus precautions 2.1.2 Installing peripheral devices and their configuration. 2.1.3 Software and drivers installation. 2.1.4 Working on windows and application software, using internet 2.2. Programming 2.2.1 Introduction Visual basic environment.	4 2 4 6 4
	2.2.2 Interface, properties of interface components and coding 2.2.3 Using different controls 2.2.4 Handling arrays in VB. Handling loops in VB. 2.3. Computer programs in surveying 2.3.1 Executing and debugging programs for different surveying techniques.	5 13 5 5 12
3	SS-114 Technical Drawings & Drafting 3.1. 3.1.1 Practice to identify and draw different types of lines. 3.1.2 Perform distruntion of drawing sheet and drawing title strip and title blocks. 3.1.3 Practice to draw geometric figures such as triangle, quadrilateral, polygon, circle. 3.2. Scale 3.2.1 Construction of Linear, diagonal scales and, Plain scales of various large and small representative fractions. 3.2.2 Drawing of reticules and grids 3.2.3 Construction of grid projection and plotting of coordinates on different scales 3.3. Orthographic projection 3.3.1 Parallel and central projections, rules to draw orthographical projections 3.4. AutoCAD 3.4.1 Introduction to AutoCAD , drawing and editing tools 3.4.2 Drawing of 2D figures 3.4.3 Drawing views of 3D solids	180 8 4 8 32 16 32 20 20 24 16
4	SS-115 Geodesy-I 4.1. Precision Leveling and Heights	60

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	4.1.1	Practice to set up level machine and observation procedure at a station.	6
	4.1.2	Running of a First order leveling line of about one kilometer in length between two bench marks. Establishment of two permanent bench marks in between.	12
	4.1.3	Computation and adjustment of the level line	12
	4.2.	Geodetic Astronomy	
	4.2.1	Identification of Polaris from pointer star and other stars	6
	4.2.2	Determination of Azimuth/Bearing of a line by making observations to Polaris.	9
	4.2.3	Determination of Azimuth/Bearing of a line by making observations to Sun using Solar Prism.	9
	4.2.4	Determination of Latitude of a point by astronomical observations.	6
5		SS-116 Database Designs	60
	5.1.	5.1.1 Introduction to MS-ACCESS	8
		5.1.2 Creating tables, design view, SQL view	9
		5.1.3 Queries	9
		5.1.4 forming	9
		5.1.5 reports	9
		5.1.6 Creating DBMS	16
Total			480

2nd SEMESTER

Sr.No.	Detail of Topics	Practical Hours
1	<p>SS 121 Surveying II</p> <p>1.1. Traversing</p> <p>1.1.1 practice to observe angle between forward and backward station, Measurement of distance with chain , tape or EDM</p> <p>1.1.2 Running of a closed traverse line of about 2 kms between two known points.</p> <p>1.1.3 Computation and adjustment of the traverse line.</p> <p>1.2. Triangulation and Trilateration</p> <p>1.2.1 Measurement of base and extension of control work by triangulation method with observation of bearing at one end of base.</p> <p>1.2.2 Reconnaissance, preparation of stations and intersected points with the help of plane table. Description of station, Monumentation.</p> <p>1.2.3 Angle and distance observation of a triangle, a centered polygon and a braced quadrilateral for horizontal and vertical control.</p> <p>1.2.4 Computation and adjustment of the triangles, polygon and braced quadrilateral.</p> <p>1.3. Global Positioning System (GPS)</p> <p>1.3.1 Setting up GPS and configuration</p> <p>Static observations to provide control points</p> <p>1..3.2 Downloading and processing of GPS data</p> <p>SS-212 Photogrammetry-I</p> <p>2.1. Basic Concepts</p> <p>2.1.1 Photograph info such as scale of photo, strip number, photo number, date and time of photo, fudicial marks, and PP point.</p>	<p>180</p> <p>10</p> <p>32</p> <p>18</p> <p>10</p> <p>10</p> <p>16</p> <p>16</p> <p>16</p> <p>16</p> <p>28</p> <p>24</p> <p>180</p> <p>16</p>

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	2.1.2 Manual inner orientation	16
	2.1.3 Manual relative orientation	20
	2.1.4 Difference of height using parallax bar	12
	2.1.5 Types of aerial cameras, Main parts of aerial camera, Focal plane and fiducial marks	20
	2.2. Stereoscopic Viewing	
	2.2.1 Demonstration of stereoscopes	10
	2.2.2 Viewing photographs stereoscopically	12
	2.2.3 Depth perception	14
	2.2.4 Interpretation of different features	22
	2.2.5 Radial line orientation	18
	2.2.6 Mapping using stereoscopes	20
3	SS-124 Cartography	120
	3.1. Map Design	
	3.1.1 Symbolology	32
	3.1.2 Color scheme of maps, Size of map, Color separation in printing	32
	3.1.3 Marginal information, Placement of various details in the map	56
4	SS-215 Remote Sensing and Image Processing	60
	4.1. Digital Image Processing	
	Practice on Data Formats (BSQ BIL BIP etc.),	12
	4.1.1 Image Sub setting	
	4.1.2 Practice in Enhancement techniques and Filters	12
	Image Mosaicing and Color Balancing, Image rectification	12
	4.1.3 classifying Image	12
	4.1.4 Registration and Re-sampling on image	12
	4.1.5	
Total		540

3rd SEMESTER

Sr.No.	Detail of Topics	Practical Hours
1	SS-211 Surveying-III	720
	1.1. Topographic survey using Plane Table	
	SCALE 1:1000	160
	1.1.1 Preparation of tables and accessory work in plane table.	16
	1.1.2 Provision of horizontal control by plane table traverse and vertical control by single tertiary leveling	32
	1.1.3 Original survey of an area of about 5 hectares by radiation /intersection method.	64
	1.1.4 Contouring at 0.5 meter interval using level and staff.	32
	1.1.5 Preparation of color trace and height trace	16
	SCALE 1:10000	200
	1.1.6 Mounting plane table section on plane table.	8
	1.1.7 Projection and accessory work on plane table section.	16
	1.1.8 Plotting of control points and their checking, extension of control, making of auxiliary points for use in plane tabling.	16
	1.1.9 Original survey of an area of about one sq.km by intersection method.	64
	1.1.10 Plane table fixing by interpolation, tracing paper and three points problem methods.	16
	1.1.11 Strength of a fix. Inside and out side fix. Danger circle.	16
	1.1.12 Contouring by clinometre and clino pole	48
	1.1.13 Preparation of height book, color trace and height trace, village list etc.	16
	SCALE 1:50000	216

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	1.1.14 Mounting plane table section on plane table.	12
	1.1.15 Projection and accessory work on plane table section.	24
	1.1.16 Plotting of control points and their checking, extension of control, making of auxiliary points for use in plane tabling.	32
	1.1.17 Original survey of an area of about 8 sq.kms by intersection method.	80
	1.1.18 Contouring by clinometre and clino pole	44
	1.1.19 Preparation of height book, color trace and height trace, village list etc.	24
	1.2. Topographic survey using Total Station	144
	1.2.1 Setting up and configuring parameters	28
	1.2.2 Feature codes and attributes	24
	1.2.3 Data collection	60
	1.2.4 Data down loading/processing.	32
	Total	720

4th SEMESTER

Sr.No.	Detail of Topics	Practical Hours
1	SS-221 Geodesy-IIB 1.1. Gravimetric Survey 1.1.1 Demonstration of Gravity instrument 1.1.2 Absolute and relative gravity measurement. 1.1.3 Reduction of observations and computation	120 34 46 40
2	SS-222 Construction Survey 2.1. Setting out works 2.1.1 Project control 2.1.2 Lay out 2.2. Highway Curves 2.2.1 Setting out simple curve by deflection angle and coordinate method 2.3. Highway /road design 2.3.1 L-section and cross-section observation in the field 2.3.2 Preparing profile 2.4. Area and Volume 2.4.1 Area &volume computation	120 12 12 32 16 16 32
3	SS-224 Photogrammetry-II 3.1. Aerial Triangulation(AT) & Digital Mapping 3.1.1 Learning handling of DPW, Preparation of project. 3.1.2 Using DPWs' software 3.1.3 Aerial triangulation 3.1.4 Image setting 3.1.5 Mapping on DPWs 3.1.6 Contouring 3.1.7 Feature capturing 3.1.8 Edge matching	120 6 6 20 20 32 16 16 4

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4	SS-224- Geographic Information System (GIS)	180
	4.1. Introduction to Geographic Information System (GIS)	
	4.1.1 introduction to ArcGIS software	2
	4.1.2 using Arc Catalog	2
	4.2. Key Components	
4.2.1 using Arc Map software	10	
4.3 GIS Data Models		
4.3.1 Working with Raster & Vector Data	8	
4.3.2 Comparison between raster & vector data	8	
4.4. Data Layers colors and Symbology		
4.4.1 Working on shape files and feature classes	16	
4.4.2 Adding attributes	4	
4.4. Data Sources & Capturing Techniques		
4.4.1 Scanning maps and georeferencing and adjustment	12	
4.4.2 On-screen digitizing of different features	34	
4.4.3 Open and working with attributes table, changing display of attribute tables	14	
4.4.4 Dynamic Labels, Setting rules for placing labels, Interactive labels and creating annotation	10	
4.4.5 Digitizing errors, Topological Errors, Errors in base data, Scanning errors ,Plotting errors	10	
4.5. Data Visualization		
4.5.1 Adding/creating symbology	10	
4.5.2 Querying data, Geoprocessing	10	
4.5.3 Editing features and attribute values	10	
4.5.4 data conversion	10	
4.5.5 Map lay-out / printing	10	
Total		540

LIST OF EQUIPMENT / INSTRUMENTS

<u>SL.NO.</u>	<u>INSTRUMENTS</u>	<u>QUANTITY</u>
1	Computers-PIV	30
2	Map Scanner	01
3	Plotter A0	01
4	Gps	12
5	Total Stations	11
6	Photogrammetry	10
7	Theodolite	07
8	Levels	40
9	Chains and Tapes	44
10	Plane Tables and Accessories	40
11	Planimeter	02
12	Drawing Instrument	25

LIST OF SOFTWARE

<u>SL.NO.</u>	<u>NAME OF SOFTWARE</u>	<u>USED FOR</u>
1.	ArcGIS	GIS
2.	Erdas Image	GIS
3.	12d Model	TOTAL STATION
4.	LisCAD	TOTAL STATION
5.	Prolink	TOTAL STATION

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6.	Foresight	TOTAL STATION
7.	Skipro	GPS
8.	Trimble Geomatic Office	GPS
9.	AutoCAD map	DRAWING

LIST OF BOOKS

SUBJECT	BOOKS RECOMMENDED
SURVEYING	<ul style="list-style-type: none"> • INTRODUCTION TO SURVEYING BY ANDERSON, JAMES M • SURVEYING BY BANISTER, A • TEXTBOOK OF SURVEYING BY SHAHANI, P. B • SURVEYING FOR ENGINEERS BY UREN, J • PLANE AND GEODETIC SURVEYING BY CLARK DAVID • INTRODUCTORY SURVEYING BY WIRSHING, JAMES R • SURVEYING AND LEVELLING BY KANETKAR, T. P • ADVANCED SURVEYING BY SHAHANI, P. B • SURVEYING BY PUNMIAB. C • A TEXTBOOK OF SURVEYING BY SHARMA, JAWAHAR • A TEXTBOOK OF ADVANCED BY SHARMA, JAWAHAR • FUNDAMENTALS OF SURVEYING BY ROY, S. K • SURVEYING BY DUGAL, S. K
MATHEMATICS	<ul style="list-style-type: none"> • A TEXT BOOK OF ALGEBRA AND TRIGONOMETRY BY PUNJAB TEXT BOOK BOARD LAHORE. • A TEXT BOOK OF CALCULUS AND ANALYTIC GEOMETRY BY PUNJAB TEXT BOOK BOARD LAHORE • CALCULUS WITH ANALYTIC GEOMETRY BY YUSAF, S. M • PLANE AND SPHERICAL TRIGONOMETRY BY BRENKE, WILLIAM C
INTRODUCTION TO COMPUTER AND PROGRAMMING	<ul style="list-style-type: none"> • COMPUTER STUDIES BY FRENCH, C. S • COMPUTER VIRUS AND ANTI VIRUS BY HRUSKA, JAN • COMPUTER FUNDAMENTALS BY GOSWAMI, AMITESH • COMPUTER FUNDAMENTALS BY SINHA, P. K
TECHNICAL DRAWINGS AND DRAFTING	<ul style="list-style-type: none"> • ADVANCED TECHNIQUE IN AUTOCAD BY THOMAS, OBERT M. • INSIDE AUTOCAD BY RAKER, D • A HAND BOOK FOR DRAWING BY KHOSO, NABI BUX

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	<ul style="list-style-type: none"> • TECHNICAL DRAWING BY FREDERICK E. GIESECKE • PRICIPLES OF TECHNICAL DRAWING BY FREDERICK E . GIESECKE
GEODESY	<ul style="list-style-type: none"> • GEODESY THE CONCEPT BY VANICK,PETER • GEODESY BY BOMFORD,G • ASTRONOMY BY MOCHE,DINAH L • GLOBAL POSITIONING SYSTEM BY WELLENHOF,B.HOFF • INTRODUCTION TO GEODESY BY EWING, CLAIR E. • SPHERICAL ASTRONOMY BY WOOLARD, EDGAR
DATABASE DESIGN	<ul style="list-style-type: none"> • DATA BASE MANAGEMENT BY GORDON C. EVEREST • FUNDAMENTALS OF DATABASE SYSTEMS BY ELMASRI,RAMEZ • PRINCIPLE OF DATA -BASE MANAGEMENT BY MARTIN,JA • DATA BASE DESIGN BY RYAN K. STEPHENS AND RONALD R PLEW
PHOTOGRAMMETRY	<ul style="list-style-type: none"> • ELEMENTARY AIR SURVEY BY KILFORD,W • ELEMENTS OF PHOTOGRAMMETRY BY RAUL R . WOLF • TEXT BOOK OF PHOTOGRAMMERY BY K.K. RAMPAL
CARTOGRAPHY	<ul style="list-style-type: none"> • ELEMENT OF CARTOGRAPHY BY RBINSON,ARTHUR S • BASIC CARTOGRAPHY FOR STUDENTS BY ANSON, R.W • CARTOGRAPHY BY KRAAK,MNNO JAN
SURVEY COMPUTATION	<ul style="list-style-type: none"> • THEORY OF PROBABILITY BY JEFFERY,HAROLD • BASIC STATISTICS BY LEABO,DICK A • SURVEY ADJUSTMENTS AND LEAST BY RAINFORD,HUME F • PROBABILITY BY SEMOUR,LIPSCHUTZ
RS AND IMAGE PROCESSING	<ul style="list-style-type: none"> • STELLITE REMOTE SENSING BY HARRIS,RAY • PRINCIPLES OF REMOTE SENSING BY CURAN,PAUL J • INTRODUCTION TO REMOTE SENSING BY RACKNELL,ARTHUR • DIGITAL REMOTE SENSING BY NAG,P • REMOTE SENSING BY SLATER,PHILIP N. • REMOTE SENSING AND IMAGE BY LILLESAND
MAP PROJECTIONS	<ul style="list-style-type: none"> • ELEMENT OF MAP PROJECTION BY DEETZ,CHARLES • INTRODUCTION TO MAP PROJECTIONS BY McDONNELL,PORTER • ELEMENT OF CARTOGRAPHY BY RBINSON,ARTHUR S
CONSTRUCTION SURVEYING	<ul style="list-style-type: none"> • A TEXTBOOK ON HIGHWAY ENGINEERING BY BHANUT,K.L • SURVEYING FOR CONSTRUCTION BY IRVIVINE,WILLIAM • SURVEYING WITH CONSTRUCTION BY KAVANAGH,BARRY F.
PROJECT PLANNING & COST ESTIMATION	<ul style="list-style-type: none"> • A TEXTBOOK OF ESTIMATING AND BY AZIZ,M.A • ESTIMATING AND COSTING BY KHAN,M.SAQIB • ESTACODE BY HAMID ALI • FUNDAMENTAL RULES AND CIVIL SERVICE BY DOGAR,TUFAIL
GEOGRAPHIC INFORMATION	<ul style="list-style-type: none"> • PRICIPLES OF GIS BY BURROUGH AND MC DONNELL

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SYSTEM(GIS)	<ul style="list-style-type: none">• USING ARCGIS BY ESRI.
COMMUNICATION AND INTERPERSONAL SKILLS	<ul style="list-style-type: none">• COMMUNICATION AND INTERPERSONAL SKILLS BY ELAINE DONNELLY,• LIENDSEY NEVILLE• COMMUNICATION AND INTERPERSONAL Skills BY SECHULZ.

EMPLOYABILITY OF PASS-OUTS

The skilled trainees would get the opportunities of jobs in the following departments and companies.

- Survey of Pakistan
- OGDCL
- NHA
- 477 Army Survey Group
- WAPDA
- Irrigation department
- Urban and rural development authorities
- Pakistan Railways
- Construction Companies
- Surveying and Mapping Agencies
- Etc.

MINIMUM QUALIFICATION OF TEACHER

B.A, /B.Sc with Advanced Diploma in Land Survey