West Bengal State Council of Technical & Vocational Education and Skill Development
(Technical Education Division)

Syllabus
of

Diploma in Mine Surveying [MIS]

Part-II (4th Semester)

Revised 2022

Syllabus for Semester -4 (Part-II) of the Full time Diploma Program in Mine Surveying

Curriculum Structure of Semester- 4, (Part-II)

Sl. No.	Category of Course	Code no.	Course Title	Class level work			Credit	Marks
				L	T	P		
1	PC	MSPC202	Photogrammetry	2			2	100
2	PC	MSPC204	Setting out of Curves	2			2	100
3	PC	MSPC206	Tacheometry and Layout Survey	2			2	100
4	PC	MSPC208	Triangulation Survey	2			2	100
5	PC	MSPC210	Trilateration and Errors adjustment	2			2	100
6	PC	MSPC212	Modern Survey Instruments	2			2	100
7	PC	MSPC214	Tacheometry and Layout Survey Lab	0	0	3	1.5	100
8	PC	MSPC216	Setting out of Curves Lab	0	0	3	1.5	100
9	PC	MSPC218	Triangulation Survey Lab	0	0	3	1.5	100
10	PC	MSPC220	Modern Survey Instrument Lab	0	0	3	1.5	100
11	PE	MSPE202	Any one from the list	2	0	0	2	100
12	Minor Project	Proj.202		0	0	4	2	100
	Total			**14**	**0**	**16**	**22**	**1200**
Students contact hours per week: 30 Hours.								
Each Theory and Practical period is of one hour.								
L- Lecture, T- tutorial, P-Practical, PC- Program Core Course, PE-Program Elective Course, AU-Audit Course								

No.	**Program Elective- Paper options**
1.	Mine Environment and Ventilation
2.	Mining Geology

Theoretical Courses

Course-1 (Semester-4)	
Course Code	**MSPC202**
Course Title	Photogrammetry
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics ,Physics , Engineering Drawing
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Instruments and Accessories required for Photogrammetry
- Purposes and classification of Photogrammetry;
- Terminologies used in Photogrammetry;
- Expression of Scale of Plan or map in different Photogrammetry;
- Interpretation of 2D and 3D parameters for plan preparation from Photographs;
- Different methods of Photo interpretation for plan preparation;
- Solving numerical problems on Photogrammetry;
- Application of Photogrammetry in Surveying .

Course Content	
Unit-1	**Introduction:** Scope, importance & different type of photogrammetry surveying
Unit-2	**Terminologies and Derivation:** Terminology used in Aerial photogrammetry like perspective center, plumb points, principal points, Isocenters, principal plane. Horizontal Trace & plate parallels, Scales & Distortion of the vertical photograph, Distortion of the vertical

	photograph, Distortion due to height or relief, Scale & Distortion of the oblique photograph.
Unit-3	**Principles:** Principles of terrestrial photogrammetry :- Different methods adopted: (1) Graphical method (2) Analytical method, Stereo photogrammetry & field work; Elementary idea about photogrammetry surveying.
Unit-4	**Plotting:** Aerial photogrammetry, Flying photography, Ground controls & compilation or mapping. Elementary ideas of instruments used in aerial surveying such as : (a) Aero plane (b) Aerial camera (c) Accessories required for interpretation & plotting.
Unit-5	**Numerical:** Flight planning, Scale of vertical photograph, Scale of Tilted Photograph, Relief displacement calculation.

Course outcomes:

After completion of this course students will be able to:

- Define Photogrammetry, state the terminologies, Draw the diagram related to Photogrammetry;
- Derive the formula related to Photogrammetry to find the Scale of plan or map;
- Sum up the necessities and scope of photogrammetry for different Surveying Application;
- Calculate the scale of different Photographs, Do the flight planning, measure the RL of a particular station;
- Apply the steps of preparation of plan by different methods from Photographs .

Title of the Book	Name of Authors	Name of the Publisher
Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling	N. Basak	Tata McGraw Hill

Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press
Plane Surveying	Dr. Alak De	S. Chand &Company

Course-2 (Semester-4)	
Course Code	**MSPC204**
Course Title	Setting out of Curves
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Purposes and classification of curves used under different situations;
- Elements and designation of simple circular curve;
- Setting out of simple circular curves by different methods and solving numerical problems;
- Necessity of introducing compound curve, its elements and setting out work;
- Necessity of introducing reverse curve, its elements and setting out work;
- Solving numerical problems on compound and reverse curves;
- Necessity of introducing transition curve, super elevation and determination of its length;
- Gradients, types and setting out of vertical curves.

Course Content	
Unit-1	**Introduction to curves:** Definition, uses and purpose of introducing curve Classification of curves and their brief description Salient features and terms used in simple circular curve Elements of simple circular curve: tangent length, length of long chord, length of curve, apex distance, mid ordinate, chainages of tangent points Designation of simple circular curve and relationship between radius and degree of curve Numerical problems on degree and elements of simple circular curve
Unit-2	**Methods of setting out simple circular curve:** Classification of methods of setting out simple circular curve and their brief description Setting out simple circular curve (derivation of formula and procedure of setting out) by a) Offsets from long chord b) Offsets from the tangents c) Successive bisection of chords d) Offsets from the chords produced e) Rankine's method of deflection angles f) Two theodolites method g) Tacheometric method Numerical problems on different methods
Unit-3	**Compound and reverse curves** Elements of a compound curve and relationship between the elements for Case I – I, R_S, R_L, I_1 or I_2 are given and T_S, T_L and I_2 (or I_1) required to be computed. Case II- I, R_S, R_L and T_S are given and I_1, I_2 and T_L required to be computed. Setting out a compound curve Numerical problems on compound curves. Elements of reverse curve Setting out reverse curve Numerical problems on reverse curves

Unit-4	**Transition curves** Description of transition curve and basic criteria for its design Advantages of introducing transition curve Super elevation and derivation of formula for super elevation Effect of friction on super elevation of roadway Numerical problems on super elevation Determination of length of a transition curve by a) Method of an arbitrary gradient b) Method of time rate c) Method of rate of change of radial acceleration Numerical problems on length of a transition curve
Unit-5	**Vertical curves** General description and purpose of introducing vertical curves Gradient of highway or railway and its types Rate of change of gradient and Length of vertical curve Types of vertical curves Derivation of equation of a vertical curve Method of tangent correction and procedure for setting out vertical curve. Numerical problems

Course outcomes:

After completion of this course students will be able to:

- State the reasons of introducing different types of curves under different situations, elements of curve and draw sketches;
- Explain procedure of formula derivation and setting out works for different methods of setting out of simple circular curve;
- Explain necessity of introducing compound and reverse curve, their elements and setting out work;
- Describe design criteria and purposes of transition curve, super elevation, determination of length of transition curve by different methods;

- Classify vertical curves and explain the procedure of formula derivation and setting out work.

Title of the Book	Name of Authors	Name of the Publisher
Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling	N. Basak	Tata McGraw Hill
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press
Plane Surveying	Dr. Alak De	S. Chand &Company

Course-3 (Semester-4)	
Course Code	**MSPC206**
Course Title	Tacheometry and Lay out Survey
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics and Engineering Drawing
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Principle and scope of Tacheometric surveying;
- Tacheometric constants and their determination;

- Anallatic lens and its relative advantages and disadvantages in Tacheometric surveying;
- Derivation of distance and elevation formula with horizontal and inclined line of sight;
- numerical problems on Tacheometric surveying;
- Importance and necessity of Lay out survey;
- Control points- Horizontal, Vertical, Reference station of control points;
- Setting out of buildings, slopes on surface;
- Setting out survey for center-line and maintaining the verticality of pillars in underground mine

Course Content	
Unit-1	**Tacheometry** Principle of Tacheometric survey Stadia and tangential methods of tacheometric survey Principle of stadia method Determination of Tacheometric Constants (i) multiplying constant by field measurement and additive constant by direct measurement (ii) both constants by field measurement Anallatic lens: its uses, advantages and disadvantages Scope of tacheometric surveying Factors affecting accuracy of Tacheometric Surveying Standard of precision for tacheometric surveying Sources of errors in Tacheometric surveying Advantages and disadvantages of Tacheometric surveying
Unit-2	**Distance and Elevation Formulae** Derivation of Distance and Elevation Formulae for inclined sights with staff held vertical Derivation of Distance and Elevation Formulae for inclined sights with staff held

	Normal Relative advantages of Vertical and Normal Staff holding Standard of precision for tacheometric surveying Factors affecting accuracy of tacheometric surveying Numerical problems on determination of tacheometric constants Numerical problems on horizontal distance and reduced levels of survey stations
Unit-3	**Lay out Survey:** Introduction Control points or Stations Factors to be considered to select the position of control points Reference Station of Control points Horizontal Control points: Primary and Secondary Vertical control points: the process of establishing the same Grade Stakes Sources of errors in Layout Surveying Mistakes in Lay out Surveying
Unit-4	Laying out of building by center-line Setting out slope of earth work by(a)Level instrument (b)theodolite Laying out of center-mark of a sinking shaft Extension of center-line in board and pillar method of underground mine workings Method of ensuring the coincident verticality of pillars for working in contiguous seams

Course outcomes:

After completion of this course students will be able to:

- Explain the principle of Tacheometric surveying;
- Determine Tacheometric constants from given data;
- Derive distance and elevation formula for different topographical condition;
- Solve numerical problems n Tacheometric Surveyig;
- Explain the importance of Lay out survey;
- Describe the steps required for laying out of required features in surface and underground .

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Elementary Surveying	Charles D. Ghilani,Paul R. Wolf	Prentice Hall
Surveying	M.Das Saikia, B.M.Das M.M.Das	PHI Learning Pvt. Ltd
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Mine Surveying and Levelling(Vol-II & III)	S. Ghatak	Coalfield Publisher
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press

Course-4 (Semester-4)	
Course Code	**MSPC208**
Course Title	Triangulation Survey
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Basic principle of triangulation, its uses and classification;
- Triangulation figures, strength of figures;
- Different types of towers and signals and their inter-visibility;
- Instruments and methods used for base line measurement and angular measurement;
- Satellite station, its purpose, reduction to center and determination of bearings of different directions from satellite station;
- Computation of lengths, azimuths, latitudes and departures of all sides, adjustments of measured angles etc;

Course Content	
Unit-1	**Introduction to triangulation:** Description of triangulation Uses of triangulation survey Classification of triangulation system Triangulation figures and arrangement of triangles Criteria for selection of the arrangement of triangles Framework of primary triangulation for a country

	Strength of figure
Unit-2	**Field work in triangulation before measurement:** Reconnaissance Selection of triangulation stations Inter-visibility of stations Determination of elevations of stations when a) No obstruction due to intervening ground b) Obstruction due to intervening ground Marking of triangulation stations Different types of towers and signals used in triangulation Selection of site for base line
Unit-3	**Measurements in triangulation** Measurement of base line by a) Rigid bar (Colby apparatus) method b) Tapes and wires method c) EDM instrument method Corrections to base line measurement Extension of the base line Instruments used for measurement of horizontal angles Measurement of horizontal angles by a) Method of repetition b) Method of reiteration Field checks on measured angles
Unit-4	**Satellite station:** Purpose of satellite station Reduction to center Determination of bearings of the directions observed from satellite station **Computations in triangulation**: a) Adjustments of observed angles b) Computation of lengths c) Computation of azimuths and latitudes and departures of all sides d) Computation of independent coordinates Numerical problems

Course outcomes:

After completion of this course students will be able to:

- State basic principle of triangulation, its uses and classification;
- Explain triangulation figures, strength of figures, towers, signals and their inter-visibility;
- Describe the instruments and methods used for base line measurement and angular measurement;
- Explain satellite station, its purpose, reduction to center and determination of bearings of different directions from satellite station;
- Compute lengths**, a**zimuths, latitudes and departures of all sides and independent coordinates and solve numerical problems.

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Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication

Course-5 (Semester-4)	
Course Code	**MSPC210**
Course Title	Trilateration and Errors adjustment
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Trilateration and its uses, merits and demerits;
- Trilateration figures and their strength and precision in trilateration;
- Different types of measurements in trilateration and reduction of slope distance from vertical angle and elevations;
- Different types of errors in surveys and important terminology;
- Laws of weights, Theory of least squares for adjustment of errors,
- Station and figure adjustments in different conditions.

Course Content	
Unit-1	**Introduction to trilateration:** Brief description of trilateration survey; Uses of trilateration; Merits and demerits of trilateration; Comparison of trilateration with triangulation; Geometric figures used in trilateration; Precision in trilateration; Description of check angle, vertical angle, angle of elevation, angle of depression and zenith angle; Instruments and accessories used in trilateration.
Unit-2	**Operations in trilateration:** Reconnaissance, distance measurement, angles measurement, leveling; Computation of angles of each triangle from measured sides using cosine or any other formula; Derivation of formula for reduction of slope distance from vertical angles; Derivation of formula for reduction of slope distance from elevations; Numerical problems on reduction of slope distance.

Unit-3	**Theory of errors:** Types of errors Definitions: Observation, Types of observation, Observed value of a quantity, True value of a quantity, Most probable value (MPV), True error, Residual error, Observation equation, Conditioned equation; Important terms associated with precision for observations of equal weight: Standard deviation, Variance, Standard error of the mean, Standard error of the single observation, Most probable error, Most probable error of the mean, Maximum error etc. and Numerical problems; Laws of weights: Definition and allocation of weights, Important terms associated with precision for observations of different weights: Standard deviation, Variance, Standard error of the mean, Standard error of the single observation, Most probable error, Most probable error of the mean, Maximum error etc. and Numerical problems;
Unit-4	**Adjustment of errors:** Corrections to field measurements with a closing error; Theory of least squares: Normal equations method for adjustment of observations of equal and unequal weights. Station adjustment: a) when the horizon is closed with the angles of a) equal weights and b) unequal weights; Figure adjustment of a plane triangle with equal and unequal weights Adjustment of a braced quadrilateral with equal weights by a) method of least squares and b) Approximate method.

Course outcomes:

Course outcomes	
After completion of this course students will be able to:	
CO1	State basic principle of trilateration, its uses, advantages, disadvantages and classification;
CO2	Explain geometrical figures , check angles, zenith angle and different types of

	measurement in trilateration survey;
CO3	Derive formulae and solve problems for reduction of slope distance from vertical angles and elevations.
CO4	Explain types of errors and important terms related to theory of errors;
CO5	Explain laws of weights, theory of least squares and solve numerical problems on station adjustment, figure adjustment of a triangle and braced quadrilateral.

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Elementary Surveying	Charles D. Ghilani,Paul R. Wolf	Prentice Hall
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying	M.Das Saikia, B.M.Das M.M.Das	PHI Learning Pvt. Ltd
Surveying (Volume-II &III)	Dr. K.R. Arora	Standard Book House
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press

Course-6 (Semester-4)	
Course Code	**MSPC212**
Course Title	Modern Survey Instruments
No. of Credits	**2 (L: 2 , P: 0, T:)**
Pre requisites	Basic knowledge of Mathematics ,Physics
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Definition of Electronic Distance measurement
- Basic terminologies related to EDM and use

- Different methods of measurement of distance by EDM
- Different types of EDM and its correction to be made for operation
- Numerical related to EDM
- Introduction and use of other modern Instruments like- Digital level, Total Station and GPS

Course Content	
Unit-1	**Electronic distance measurement**: Introduction Basic definition Use of E.D.M. Types of EDM and correction: Electro-Optical E.D.M. instruments Infrared E.D.M. instruments Effect of atmospheric condition Atmospheric calibration of instruments
Unit-2	**Methods of Distance measurement by EDM:** Measurement of Distance from transit time Measurement of Distance from phase difference Numerical on EDM: Problem on refractive index ratio for field condition, Problem for pressure temperature and humidity , Problem on microwave.
Unit-3	**Total Station** Introduction, Fundamental Parameters of Total Station, Precautions to be taken in use of Total station, Setting up of Total station , Measurement with Total Station.
Unit-4	**Global Positioning System (GPS)** Introduction and use and principle of operation.
Unit-5	**Digital Level** Introduction, advantages of Digital level, Components of Digital level and use.

Course outcomes:

After completion of this course students will be able to:

- Define Electronic Distance measurement
- Describe basic terminologies related to EDM and use
- Illustrate different methods of measurement of distance by EDM
- Explain different types of EDM and put correction in operation
- Solve numerical related to EDM
- Narrate introduction and use of other modern Instruments like- Digital level, Total Station and GPS

Title of the Book	**Name of Authors**	**Name of the Publisher**
Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Advanced Surveying	Satheesh Gopi, R Sathikumar, N Madhu	Pearson
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press
Plane Surveying	Dr. Alak De	S. Chand &Company

Practical

Course-7 (Semester-4)	
Course Code	**MSPC214**
Course Title	Tacheometry and Layout Survey lab
No. of Credits	**1.5 (L: 0 , P: 3, T: 0)**
Pre requisites	Basic knowledge of Mathematics and Engg.Drawing
Course Category	PC

Course objectives:

Objectives of this course are to:

- Implement Principle of Tacheometric surveying in the field;
- Find out Tacheometric constants in the actual field;
- Execute traversing principle and offsets taking by Tacheometric method;
- Prepare plans and sections of uneven topographical condition using Tacheometric method;
- Lay out building corners from a given plan;
- Plan and execute surveying to maintain gradient along a line in an uneven ground;

Course Content	
Experiment No.	**Name of Experiment**
1.	Finding out the distances of a closed traverse by tacheometric method
2.	Determination of Tacheometric constants by field measurement
3.	Determination of horizontal distances and Reduced Levels of points by Tacheometric method, when line of sight is horizontal and the staff held vertical.
4.	Determination of horizontal distances and Reduced Levels of points by Tacheometric method, when line of sight is inclined and the staff held vertical .

5.	Laying out of building corners from a given building plan
6.	Positioning of grade stakes along the center line of a proposed roadways and preparation of section along that line.

Course outcomes:

After completion of this course students will be able to:

- Prepare plans of closed traverse from the measurements taken with tacheometer;
- Determine Tacheometric constants from the field observation;
- Apply appropriate formula for the calculation of horizontal distances and Reduced Levels of points and prepare plans and sections ;
- Lay out building corners from a given building plan ;
- Stake out grade stakes along the center line of a proposed incline roadway.

List of Books

Title of the Book	**Name of Authors**	**Name of the Publisher**
Elementary Surveying	Charles D. Ghilani,Paul R. Wolf	Prentice Hall
Surveying	M.Das Saikia, B.M.Das M.M.Das	PHI Learning Pvt. Ltd
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Mine Surveying and Levelling(Vol-II & III)	S. Ghatak	Coalfield Publisher
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press

Practical

Course-8 (Semester-4)	
Course Code	**MSPC216**
Course Title	Setting out of Curves lab
No. of Credits	**1.5 (L: 0 , P: 3, T: 0)**
Pre requisites	Basic knowledge of Mathematics
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Purposes and classification of curves used under different situations;
- Elements and designation of simple circular curve;
- Setting out of simple circular curves by different methods and solving numerical problems;
- Necessity of introducing compound curve, its elements and setting out work;
- Necessity of introducing reverse curve, its elements and setting out work;
- Solving numerical problems on compound and reverse curves;
- Necessity of introducing transition curve, super elevation and determination of its length;
- Gradients, types and setting out of vertical curves.

Course Content	
Experiment No.	**Name of Experiment**
1.	Study and sketch of simple circular curve, compound curve, reverse curve and transition curve.
2.	Study and sketch of instruments used in setting out of curves
3.	Setting out of circular curve by offsets from the long chord method.
4.	Setting out of circular curve by perpendicular offsets from the tangent

	method.
5.	Setting out of circular curve by radial offsets from the tangent method.
6.	Setting out of circular curve by offsets from the chords produced method.
7.	Setting out of circular curve by Rankine's method.
8.	Setting out of circular curve by two theodolites method.
9.	Setting out of compound curve
10.	Setting out of reverse curve

Course outcomes:

After completion of this course students will be able to:

- Draw different types of curves by computing data of given curve problems;
- List the instruments and accessories used in field for setting out of curves;
- Apply appropriate formula for the computation of data to be used for setting out of different types of circular curves in the field;
- Explain the procedures of setting out of curves by different methods;
- Set out simple circular curves, compound curves and reverse curves in the field.

Title of the Book	**Name of Authors**	**Name of the Publisher**
Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling	N. Basak	Tata McGraw Hill
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication
Fundamental of Surveying and Levelling	R. Subramanian	Oxford University Press
Plane Surveying	Dr. Alak De	S. Chand &Company

Practical:

Course-9 (Semester-4)	
Course Code	**MSPC218**
Course Title	Triangulation Survey Lab
No. of Credits	**1.5 (L: 0 , P: 3, T: 0)**
Pre requisites	Basic knowledge of Mathematics, Engineering Drawing
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Measurement of Base line with different methods like Wheeler's method, Jaderin's method, Total station;
- Measurement of horizontal angles by Theodolite with repetition and reiteration method;
- Making adjustment of angles and plot the stations;
- Plotting a triangle with coordinate of three stations by grid plotting;
- Conducting Triangulation Survey with triangle network and plotting the site by grid plotting.

Course Content	
Experiment No.	**Name of Experiment**
1.	Study and sketch of arrangements of triangles in triangulation system
2.	Reconnaissance in triangulation survey
3.	Measurement of base line by Wheeler's method
4.	Measurement of base line by Jaderin's method

5.	Measurement of base line by Total Station
6.	Plotting of the procedure of measurement of base line
7.	Measurement of horizontal angles at a station by theodolite.
8.	Station adjustment of measured angles and plotting.
9.	Triangulation survey over a suitable ground consisting single triangular figure.
10.	Figure adjustment, computation of lengths and plotting.

Course outcomes:

After completion of this course students will be able to:

- Measure Base line with different methods like Wheeler's method, Jaderin's method, Total station;
- Measure horizontal angles by Theodolite with repetition and reiteration method;
- Make adjustment of angles and plot the stations;
- Plot a triangle with coordinate of three stations by grid plotting;
- Triangulation Survey with triangle network and plotting the site by grid plotting.

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Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
Surveying (Volume-II)	Dr. K.R. Arora	Standard Book House
Surveying (Volume-II)	Dr. B.C. Punamia	Laxmi Publication

Practical:

Course-10 (Semester-4)	
Course Code	**MSPC220**
Course Title	Modern Survey instrument Lab
No. of Credits	**1.5 (L: 0 , P: 3, T: 0)**
Pre requisites	Basic knowledge of Mathematics, Engineering Drawing
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Different Parts of EDM
- Functions of Different Menu
- Setting the Instrument at a station
- Collection of Data
- Preparation of Plan from the data
- Setting of GPS
- Data Collection by GPS
- Preparation of plan from GPS data

Course Content	
Experiment No.	**Name of Experiment**
1.	Study and sketch the Diagram of EDM
2.	Study the different components and Functional keys of EDM
3.	Study and Sketch the different Menu and Sub menu of its operation
4.	Setting and levelling of EDM over a station and Data Collection

5.	Reading taking to conduct a Survey
6.	Plotting the triangle
7.	Study the Sketch of GPS and its components
8.	Setting and Data collection by GPS
9.	Processing Steps of Collected data to get in the Plotting format
10.	Plan preparation of a site by GPS Data

Course outcomes:

After completion of this course students will be able to:

- Describe the components of Total Station
- Take reading by Total Station
- Download the data from Total Station and Plot the Plan of a site
- Set Describe the components of GPS and set the instrument for reading taking
- Download the Data and process it for plan preparation and make the plan

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Surveying (Volume-II)	S.Duggal	Tata McGraw Hill
Surveying & Levelling	N. Basak	Tata McGraw Hill
Surveying & Levelling (Volume-II)	T.P Kanetkar	Pune Vidyarthi Griha Prakashan
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Plane Surveying	Dr. Alak De	S. Chand &Company

Course -11, Programme Elective (Semester-4)	
Course Code	**MSPE202**
Course Title	Mining Geology
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	NIL
Course Category	PC

Course objectives:

Objectives of this course are to learn about:

- Introductory knowledge about geology and its branches;
- Different processes of physical geology
- General idea of structural geology
- General stratigraphy giving particular attention to certain Indian mineral/coal bearing zones;
- General economic geology giving particular attention to certain Indian mineral/coal bearing zones;
- Brief ideas about different geological mapping and prospecting methods;

Course Content	
Unit-1	1. **Basic Geology** 1.1 Brief idea about origin, age & interior of the earth. 1.2 Branches of geology: Brief description of each 1.3 Physical geology –definition of weathering, erosion and denudation. 1.4 Definition of Crystal Rock & Mineral. Physical properties of mineral, important rock forming & economic mineral. 1.5 Petrology-kinds of rock, their classification with examples. 1.6 Structural geology- a) Primary structure, definition of bedding, cross-bedding, current- bedding,

	graded bedding, ripple marks. b)Secondary structure- definition of dip, strike, fold, fault, joint & unconformity.
Unit-2	2. **Economic Geology** 2.1 Definition of ores, Ore minerals, Gangue minerals, Tenor, Grade, Metallogenic epoch Metallogenic province. 2.2 Brief idea about the following processes (sedimentation, hydrothermal deposits ,metasomatic replacement, cavity filling only)of formation of mineral deposits. 2.3 Indian occurrences & ore minerals of the following mineral deposits; Iron, Manganese, Gold, Copper, Lead-Zinc, Bauxite, Petroleum. 2.4 Brief geological idea about the following mineral deposits in India; a) Singbhum Copper & Iron ore deposit, b) Manganese deposit of Madhya Pradesh. c) Gold deposit of Karnataka.
Unit-3	3.1 Coal: Definition, Rank and grade of coal. Origin and formation of coal. Indian occurrences of coal. Difference between Lower-Gondwana and Tertiary Coals., effects of intrusives of coal bearing horizons. 3.2 Brief geological idea about the a) Jharia Coalfield. b) Ranigunj Coalfield.
Unit-4	4. **Geological Mapping and Prospecting**. 4.1 Definition- Contour map and Geological map. Recognition of the following structures: Horizontal, inclined and vertical beds, Folds, Faults, Unconformities, Dykes, sills on geological maps. **4.2** Geological prospecting -Brief knowledge about Loaming, Huishing, Probing, Trenching, Trial pits, Diamond drilling and churn drilling. Name of the different geophysical prospecting methods only.

Course outcome

After completion of this course students will be able to:

- Describe the origin, age etc. about the earth;
- Define terminologies used in different branches of geology;
- Explain the origin of mineral deposits in India;
- Identify different occurrences of economically exploitable deposits of coal;
- Explain the principles of geological mapping and interpret them;

Title of the Book	Name of Authors	Name of the Publisher
A Text Book of Geology	P.K Mukherjee	The World Press Private Limited
Principle of Engineering Geology	K.M. Bangar	Standard Publication
A Text Book of Geology	G.B. Mahapatra	CBS Publishers & Distributors
Geology of India	D.N Wadia	Tata McGraw Hill

Course-11, Programme Elective (Semester-4)	
Course Code	**MSPE202**
Course Title	Mine Environment and Ventilation
No. of Credits	**2 (L: 2 , P: 0, T: 0)**
Pre requisites	Basic knowledge of Mathematics and Mining
Course Category	PE

Course objectives:

Objectives of this course are to learn about:

- Mine environment and effects of poisonous and inflammable gases present in mine

air;

- Identify the instruments used to detect different types of poisonous and inflammable gases present in mine air;
- The principles of working of the instruments used for detection of various gases;
- The causes and preventive measures of spontaneous heating and mine fire;
- Different methods used for dealing with underground mine fire;
- Different types of mine ventilation system, controlling devices;
- Laws of friction and numerical problems on ventilation.

Course Content of Mine Environment and Ventilation	
Unit-1	**Mine gases:** Brief description of gases found in normal atmosphere and mine air Description of mixture of gases: White damp, Black damp, Stink damp, After damp, Fire damp. Oxygen deficiency and its effect Properties, occurrence, and physiological effects of Carbon dioxide, Carbon monoxide, Hydrogen sulphide, Sulphur dioxide, methane.
Unit-2	**Detection of mine gases:** Causes of detection of mine gases, detection of Oxygen deficiency by a) Oil safety lamp b) Oxygen deficiency monitor Detection of Carbon dioxide by a) Oil safety lamp b) Dragger multi gas detector Detection of Carbon monoxide by a) exposing muniah or canaries birds to the air containing CO b) P S detector c) Hopcalite detector d) Hoolamite tube e) Drager multi gas detector Detection of Hydrogen sulphide by a) M.S.A H_2S detector b) Dragger multi gas detector Detection of Methane gas by a) Flame safety lamp and b) M.S.A D-6 methanometer

Unit-3	**Mine fires and spontaneous heating:** Spontaneous combustion, Factors governing spontaneous heating of coal, Incubation period, Symptoms of spontaneous heating in underground coal mines; Preventive measures against spontaneous heating in coal stacks and opencast coal mines; Preventive measures against spontaneous heating in underground coal mines; Classification of fires, brief description of portable fire extinguishers such as C.T.C, Foam, B.C.F, CO_2 gas, Dry powder etc. Causes of surface fire and underground mine fire; Methods of dealing with underground mine fires; Types of fire stoppings
Unit-4	**Mine ventilation:** Mine ventilation and its types, Purposes of mine ventilation, Causes of natural ventilation; Natural ventilation due to unequal depths of shaft, Natural ventilating pressure (N.V.P) and its formula, Motive column, Relation between N.V.P and motive column; Laws of mine air friction, Resistance of roadways connected in series and parallel, numerical problems; Ventilation systems in mines: Boundary or unidirectional ventilation, Central or bi-directional ventilation, Ascensional ventilation, Descensional ventilation, Homotropal ventilation, Antitropal ventilation; Controlling devices: Splitting, Air-crossing, Ventilation door, Air locks, Regulator, Brattice partitions, Equivalent orifice etc. and related numerical problems.

Course outcomes:

After completion of this course students will be able to:

CO1: Develop ideas about mine environment and effects of poisonous and inflammable gases present in mine air;

CO2: State the principles and identify the instruments used to detect different types of

poisonous and inflammable gases present in mine air;

CO3: Explain the causes and preventive measures of spontaneous heating and mine fire;

CO4: Apply appropriate steps during dealing with mine fire;

CO5: Explain different types of mine ventilation system, controlling devices, laws of friction and solve ventilation problems.

Name of Authors	**Title of the Book**	**Name of the Publisher**
D.J Deshmukh	Elements of Mining(Vol-II)	Vidyasewa Prakashan, Nagpur
S. Ghatak	Mine Ventilation	Coalfield Publishers
R.D. Singh	Principles & Practices of Modern Coal Mining	New Age International
G. B. Misra	Mine Ventilation	Thacker Spink & Com. Pvt. Ltd., Kolkata

Course-12, Minor Project (Semester-4)	
Course Code	**Proj.202**
Course Title	Minor Project
No. of Credits	**2 (L: 0 , P: 4, T: 0)**
Pre requisites	Basic knowledge of Mathematics and Surveying
Course Category	Minor Project

Minor project Work is intended to provide opportunity for students to develop understanding of the interrelationship between different courses learnt during last 3 semesters and apply the knowledge gained in a way that enables them to develop & demonstrate higher order skills. The basic objective of this minor project class would be to ignite the potential of students' creative ability by enabling them to develop something which has social relevance. It should provide a taste of real life problem that a diploma-holder may encounter as a professional. The course further includes preparation of a Project Report which, among other things, consists of technical description of the project.