Department of Civil Engineering

Details of Lesson Plan

S.No.	Particulars	Details
1.	Course Name	SURVEYING-I
2.	Course Code	CE-303
3.	Academic Year	2023-24
4.	Semester	3rd SEMESTER
5.	Number of Lesson plans	24
6.	Faculty Assigned	Er. Sarvdaman Sharma

Faculty Signature

Lesson Plan No. 1	Course Name: Surveying-I Topic: Chain survey: Classification of surveys	Course No.: CE-303

Objectives	At the end of the lesson the student shall be able to: a. Articulate the concept of surveying and levelling. b. Learnt about the importance and necessity for surveying and its types. c. Illustrate about the uses of surveying. d. Learn about primary classification of plane and geodetic surveying.
Teaching Aids (if any)	a. Presentations(PPTs) b. Web sources from survey department of India.
Teaching Development	1. **Introduction** (5 minutes) - Introduce the students about the concept of surveying and levelling. - Introduce them about the objectives of surveying and levelling, uses of surveying and different types of maps drawn in surveying. - Highlight the primary and secondary classification of surveying. 2. **Development** (30 minutes) a) Discussed about the relative positions of objects on the ground. b) Importance of surveying in preparing the military maps, cadastral maps, geological maps, archaeological maps etc. c) Discussed about the difference between plane and geodetic surveying in details and where these types of survey are used. d) Classification of surveying based on instruments, based on methods, based on objects, based on nature of field etc. e) Discussed about the principles of surveying and discussing about working from whole to part. f) Discussed about the methods of linear measurements by stepping, Passometers, Perembulators, Speedometers etc. 3. **Exercise** (5 minutes) – Analysis of 20m, 20mISI and 30 m chain practically.
Closure	1. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 2. Suggested Reading - Video links https://www.youtube.com/watch?v=ZsajLQ4OiV8&list=PL20A0651466E8A776&index=7 3. Homework - Read about all the types of maps given in official website of survey department of India and brief in classroom. Spend 5 minutes to wrap up and consolidate the learning.

Evaluation	1. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 2	**Course Name: Surveying-I** **Topic: Chain survey: Reconnaissance**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: e. Articulate the concept of reconnaissance and index sketches. f. Learnt about the importance and necessity for frame work of survey. g. Illustrate about the process of doing the reconnaissance survey. h. Learn about different types of triangles used in area survey.
Teaching Aids (if any)	c. Pen and white board. d. Web sources from survey department of India.
Teaching Development	4. **Introduction** (5 minutes) - Introduce the students about the concept of reconnaissance surveying. - Introduce them about well conditional triangles and ill conditional triangles. - Highlight the use of large scale maps and small scale maps. 5. **Development** (30 minutes) g) Discussed about the full sized scale, reducing scale, enlarging scale. h) Importance of surveying in preparing the representative fraction (RF). i) Discussed about the different types of plane scale, diagonal scale, Vernier scale, comparative scale. j) Discussed about the degree of accuracy of scales and conversions. k) Discussed about the principles of surveying and discussing about working from whole to part. l) Numerical on examining that weather the triangle is well conditional or ill conditional. 6. **Exercise** (5 minutes) – Finding the RF factor for given example in classroom?
Closure	4. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 5. Suggested Reading - Video links https://www.youtube.com/watch?v=ZsajLQ4OiV8&list=PL20A0651466E8A776&index=7 6. Homework

	- 2 numerical on finding the scale of the plot? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	2. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 3	**Course Name: Surveying-I** **Topic: Principles of chain survey**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: i. Articulate the concept of principles of chain surveying. j. Learnt about the types of chains and tapes used in the area survey. k. Illustrate about the process of direct and indirect ranging. l. Learn about folding and unfolding and error checking in the chains.
Teaching Aids (if any)	e. Pen and white board. f. Web sources from survey department of India.
Teaching Development	7. **Introduction** (5 minutes) - Introduce the students about the concept of 2 basic principles of chain surveying. - Introduce them about the ranging rods, arrows, wooden pegs, chains, tapes etc. all survey instruments. - Highlight the types of direct and indirect ranging by using ranging rods simply. 8. **Development** (30 minutes) m) Discussed about the ranging rods there dimensions, metric chains, steel bands, engineer's chain, revenue chain and Gunter chain etc. n) Difference between 20m and 20 ISI mark chains. o) Discussed about cloth tape, linel tape, metallic tape and invar tape. p) Discussed about direct and reciprocal ranging. q) Discussed about the testing on chains and adjustment of chains, leader and follower etc. terms. r) Degree of accuracy in chain surveying. 9. **Exercise** (5 minutes) – Make a short note on some terms like brass rings, tallies, and links in both 20m and 30m chains?

Closure	7. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 8. Suggested Reading - Video links https://www.youtube.com/watch?v=nq_wOpJs9zk&list=PL20A0651466E8A776&index=8 9. Homework - Survey of area by using 20 m tape and 30m tape? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	3. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 4	**Course Name: Surveying-I** **Topic: Field book**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: m. Articulate the material required for surveying the area. n. Learnt about making of single line and double line field book in surveying technology. o. Illustrate about the process of direct and indirect chaining. p. Learn about folding and unfolding and error checking in the chains.
Teaching Aids (if any)	g. Pen and white board. h. Web sources from survey department of India.
Teaching Development	10. **Introduction** (5 minutes) - Introduce the students about the concept of 2 basic principles of chain surveying. - Introduce them about the ranging rods, arrows, wooden pegs, chains, tapes etc. all survey instruments in details. - Highlight the making of single line and double line field book in detail. 11. **Development** (30 minutes) s) Discussed about the size of field book used in the surveying process. t) Single sized field book in details. u) Drawings of double sized field book in details.

	v) Discussed about problems on entering the records in field book in the survey works. w) Precautions to be taken while entering the field book. x) Degree of accuracy in chain surveying. 12. **Exercise** (5 minutes) – Make a whole procedure of field work step wise ?
Closure	10. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 11. Suggested Reading - Video links https://www.youtube.com/watch?v=14x-zy54Axs&list=PL20A0651466E8A776&index=10 12. Homework - Give details on index sketch, reference sketch, symbols used in field book? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	4. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 5	**Course Name: Surveying-I** **Topic: Plotting of tie line and check line**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: q. Articulate the main stations, subsidiary stations and tie stations etc. r. Learnt about making use of base line, tie line and use of offsets in the survey work. s. Illustrate about perpendicular offsets and oblique offsets. t. Learn about number of offsets required and limiting length of the offsets.
Teaching Aids (if any)	i. Pen and white board. j. Web sources from survey department of India.
Teaching Development	13. **Introduction** (5 minutes) - Introduce the students various types of station during surveying. - Introduce them about base line, tie line and offsets in details. - Highlight about the limiting length of the offsets. 14. **Development** (30 minutes)

	y) Discussed about drawing the index sketch and explain in it about how the area is divided by using of different types of line to divide the area into well conditional triangles. z) Stations taken along main and subsidiary lines of the area of survey aa) Drawings the offsets from the simple plane area or undulated area sides of buildings. bb) Finding the limiting length of the offsets required in surveying in details. cc) Selection of survey stations. dd) Degree of accuracy in chain surveying. 15. **Exercise** (5 minutes) – To find the displacement of the plotted point on the paper by both methods of limiting length of the offset.
Closure	13. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 14. Suggested Reading - Video links https://www.youtube.com/watch?v=nAk1YBc_FAk&list=PL20A0651466E8A776&index=11 15. Homework - Give details on degree of accuracy in laying the offsets on the field? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	5. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 6	**Course Name: Surveying-I** **Topic: Chaining on sloping ground and uses of cross staff and optical square**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: u. Articulate the methods of chaining on the plane and sloping grounds. v. Learnt about stepping method and indirect methods of chaining. w. Illustrate about measure of slope with clinometers, hypotenuse allowance and by knowing the difference of levels. x. Learn about various obstacles in chaining, errors in the chain survey and

	several checks applied.
Teaching Aids (if any)	k. Pen and white board. l. Web sources from survey department of India.
Teaching Development	16. **Introduction** (5 minutes) - Introduce the students various methods of plane and sloping ground chaining. - Introduce them about hypotenuse allowance and level difference method of measurements. - Highlight about various obstacles in the chain surveying. 17. **Development** (30 minutes) ee) Discussed about obstacles in chaining where chaining is free and vision is obstructed. ff) Discussed about obstacles in chaining where chaining is obstructed and vision is free. gg) Discussed about obstacles in chaining where chaining is obstructed and vision is also obstructed. hh) To find the height of the object by using only chains and ranging rods. ii) Conceptions of magnetic bearings. jj) Various types of chain and tape corrections in details and its numerical. 18. **Exercise** (5 minutes) – To find the errors and mistakes in chain surveying.
Closure	16. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 17. Suggested Reading - Video links https://www.youtube.com/watch?v=nAk1YBc_FAk&list=PL20A0651466E8A776&index=11 18. Homework - Find a numerical on chain and tape correction taking into consideration all the errors in chain surveying? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	6. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Objectives	At the end of the lesson the student shall be able to: y. Articulate the objectives of levelling and aim of levelling. z. Learn about level surfaces and horizontal lines. aa. Illustrate about Benchmarks. bb. Learn about how to use the dumpy level and auto level.
Teaching Aids (if any)	m. Pen and white board. n. Web sources from survey department of India.
Teaching Development	19. **Introduction** (5 minutes) - Introduce the students various objectives and use of levelling also the aim to level. - Introduce them about Level surface, level line, horizontal line, vertical line and datum line. - Highlight about Benchmark, level of bubble tube, axis of telescope, axis of bubble tube etc. 20. **Development** (30 minutes) kk) Discussed briefly about various terms and terminology used in the levelling. ll) Discussed about GTS Benchmark, Permanent benchmark, temporary benchmark and arbitrary benchmark. mm) Difference between focusing and parallax. nn) To find the height of the object by using dumpy levels, auto levels, wye levels, modern tilting levels. oo) Description of dumpy level and its all parts with diagrams. 21. **Exercise** (5 minutes) – How to level the bubble tubes in auto level and dumpy levels.
Closure	19. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 20. Suggested Reading - Video links https://www.youtube.com/watch?v=6d4mERJFPpI&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=13 21. Homework - Write a brief description on back sight readings, foresight readings and intermediate readings. Spend 5 minutes to wrap up and consolidate the learning.
Evaluati	7. Reflective Questions (What, Why, Who?). Allow students to answer and

on	discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 8	**Course Name: Surveying-I** **Topic: Types of levels and staff.**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: cc. Articulate the objectives of levelling and aim of levelling. dd. Learn about different types of staffs used in the levelling operations. ee. Illustrate about invar staffs and reading taken by that staff. ff. Learn about how to use levels with the staff and take the readings.
Teaching Aids (if any)	o. Pen and white board.
Teaching Development	22. **Introduction** (5 minutes) - Introduce the students about various types of staff like target staff, self reading staff, invar staff, diaphragms etc. - Introduce them about what are the points to be remembered by the staff men. - Highlight about what are the points to be remembered by the level men. - Basics about the different types of levels. 23. **Development** (30 minutes) pp) Discussed briefly about types of staff like target staff with movable targets. qq) Discussed about sop-with telescopic staff, one length staff, folding metric staff in details. rr) Discussed about how to read the invar staff readings. ss) Description about the diaphragm, spider webs across the rings, platinum wires used in the instruments. tt) Description about the instructions or the points to be remembered by the staff man and the level man. 24. **Exercise** (5 minutes) – A small exercise on how to practice holding the staff and give commands on site.
Closure	22. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 23. Suggested Reading - Video links https://www.youtube.com/watch?v=fp0vl7T5daQ&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=14

	24. Homework - Write a brief description on back sight readings, foresight readings and intermediate readings. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	8. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 9	**Course Name: Surveying-I** **Topic: Temporary adjustment of levels.**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: gg. Articulate about the selection of suitable positions, fixing level with tripod stand. hh. Learn about approximate levelling by legs of tripod stand. ii. Illustrate about perfect levelling by the use of foot screws. jj. Learn about how to focus the eye-piece, object glass and take the staff readings effectively.
Teaching Aids (if any)	p. Pen and white board.
Teaching Development	25. **Introduction** (5 minutes) - Introduce the students about eye piece lens focussing and object glass focusing. - Introduce them about how to level by using foot screws. - Highlight about fixing the level with the tripod stands. - Basics about selection of suitable positions of objects on the ground. 26. **Development** (30 minutes) uu) Discussed briefly about how levels are fixed using the tripod stand in the field and to use the third leg of the staff effectively. vv) Discussed about simple levelling the plain and sloping ground. ww) Discussed about differential levelling and in details about the temporary adjustment used before levelling. xx) Description about reciprocal levelling in details on ponds and rivers. yy) Description about fly levelling concepts and its practical use. 27. **Exercise** (5 minutes) – A small practical exercise in the classroom by adjusting the instrument temporarily.
Closure	25. Summarize the Lesson Learning Outcomes and get affirmation from students on these.

	26. Suggested Reading - Video links https://www.youtube.com/watch?v=fp0vl7T5daQ&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=14 27. Homework - Write a brief description on back sight readings, foresight readings and intermediate readings. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	9. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 10	**Course Name: Surveying-I** **Topic: Characteristics of Contours**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: kk. Articulate about the distance by stadia method. ll. Learn about contour line, contour interval, and horizontal equivalent. mm. Illustrate about objective of preparing contour map and uses of contour maps. nn. Learn about characteristics of contours, how to draw contours of hills, valleys, ponds, vertical cliff, summit, depressions, saddle etc.
Teaching Aids (if any)	q. Pen and white board.
Teaching Development	28. **Introduction** (5 minutes) - Introduce the students about direct and indirect methods of contouring. - Introduce them about horizontal equivalent, contour line, contour interval. - Highlighted about indirect methods of contours like cross section method, by using square and rectangular method. - Basics about selection of suitable positions of objects on the ground. 29. **Development** (30 minutes) zz) Discussed briefly about method of interpolation of contours and the process of location of contours proportionately between the plotted points. aaa) Discussed about the contour gradients and why during preliminary survey they are used for roads in hilly areas. bbb) Discussed about location of contour gradient.

	ccc) Field location of grade contour by abney level and by levelling the instrument. ddd) Description in brief about different methods and characteristics of contouring. 30. **Exercise** (5 minutes) – A small practical exercise in the classroom by adjusting the instrument temporarily.
Closure	28. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 29. Suggested Reading - Video links https://www.youtube.com/watch?v=xSDAt6khKw8&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=19 30. Homework - Write a brief description on back sight readings, foresight readings and intermediate readings. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	10. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 11	**Course Name: Surveying-I** **Topic: Prismatic compass, Surveyor's compass**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: oo. Articulate about True meridian, magnetic meridian, arbitrary meridian, grid meridian. pp. Learn about designation of magnetic bearings i.e. whole circle bearing (WCB) and Quadrantal bearing (QB). qq. Illustrate about magnetic declination and magnetic dip. rr. Learn about isogonic and agonic lines.
Teaching Aids (if any)	r. Pen and white board.
Teaching Development	31. **Introduction** (5 minutes) - Introduce the student's principle of compass surveying. - Introduce them about the types of compass used in the surveying work.

	- Highlighted about the temporary adjustment of prismatic compass and field procedure of observing bearings. - Basics about fore bearings and back bearings. 32. **Development** (30 minutes) eee) Discussed in details about the prismatic compass how it works what is compass box and magnetic needle and graduated ring. fff) Discussed about sight vane, prism and dark glassed used in the prismatic compass. ggg) Discussed about brake pins and lifting pins and the glass cover used. hhh) Complete diagrammatic view and practical view of prismatic compass given to the students. iii) Description in brief about the surveyor's compass and its components like eye vane with fine sight, graduated rings for 0 degree to 90 degree. 33. **Exercise** (5 minutes) – A small practical exercise on how to setup the compass both prismatic and surveryor's on the field.
Closure	31. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 32. Suggested Reading - Video links https://www.youtube.com/watch?v=xSDAt6khKw8&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=19 33. Homework - Make a diagram for prismatic and surveyor's compass? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	11. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 12	Course Name: Surveying-I Topic: Local attraction	Course No.: CE-303

Objectives	At the end of the lesson the student shall be able to: ss. Articulate about fore bearing and back bearing in compass surveying. tt. Learn about designation of magnetic bearings i.e. whole circle bearing (WCB) and Quadrantal bearing (QB). uu. Illustrate about methods of application of correction in traversing. vv. Learn about
Teaching Aids (if any)	s. Pen and white board.
Teaching Development	34. **Introduction** (5 minutes) - Introduce the student's principle of compass surveying. - Introduce them about the types of compass used in the surveying work. - Highlighted about the temporary adjustment of prismatic compass and field procedure of observing bearings. - Basics about fore bearings and back bearings. 35. **Development** (30 minutes) jjj) Discussed in details about various problems on whole circle bearing and quadrantal bearings. kkk) Solved various problems on fore and back bearings. lll) Discussed about problems on magnetic declination. mmm) Solved numerical on fore bearings, true bearing magnetic bearings, and declination in east and west. nnn) Description in brief about plotting of compass traverse by parallel meridian through each station, measurement of bearings of traverse legs. 36. **Exercise** (5 minutes) – A small practical numerical on whole circle bearing and correction of fore bearing and back bearings.
Closure	34. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 35. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=37 36. Homework - Write the difference between WCB and QB? - Spend 5 minutes to wrap up and consolidate the learning.

Evaluation	12. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 13	**Course Name: Surveying-I** **Topic: Graphical and analytical adjustment of traverse**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: ww. Articulate about the methods of traversing. xx. Learn about plotting the closed traverse and open traverse and the difference between them. yy. Illustrate about methods of application of correction in traversing. zz. Learn about the obstacles in traversing.
Teaching Aids (if any)	t. Pen and white board.
Teaching Development	37. **Introduction** (5 minutes) - Introduce the student's about closed traverse and open traverse and the difference between them. - Introduce them about methods of traversing like chain traversing. - Highlighted about the compass traversing and theodolite traversing. - Basics about plane table traversing. 38. **Development** (30 minutes) ooo) Discussed in details about the chain traversing by using chain angle and also discussed about all the methods involved in doing the chain traversing. ppp) Solved various compass traversing problems. qqq) Discussed in brief about compass traversing and theodolite traversing. rrr) Checks on closed traverses like check on angular measurements and checks on linear measurements. sss) Description in brief about about checks on open traverse like taking cut-off lines and taking an auxiliary point. 39. **Exercise** (5 minutes) – A small practical on open and closed traverse across river and pond.
Closure	37. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 38. Suggested Reading - Video links

	https://www.youtube.com/watch?v=2EYQDwcizcE&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=12 39. Homework - Explain the process of taking the auxiliary points in detail? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	13. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 14	**Course Name: Surveying-I** **Topic: Plane table**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: aaa. Articulate about the principles of plane table surveying. bbb. Learn about various accessories of plane table used as surveying equipment. ccc. Illustrate about the difference between the plane and telescopic alidade. ddd. Learn about the orientation principle in the plane table surveying.
Teaching Aids (if any)	u. Pen and white board.
Teaching Development	40. **Introduction** (5 minutes) - Introduce the student's the various accessories of plane table like magnetic compass, needle, alidade, u fork etc. - Introduce them about methods of traversing like chain traversing. - Highlighted about the orientation methods in survey. - Basics about the basics and principles of plane table surveying. 41. **Development** (30 minutes) ttt) Discussed in details the principle of parallelism that are the rays drawn from the station to the objects on the paper and parallel lines drawn. uuu) Discussed in detail the size of plane table, material with which it is made, and the process of fixing the sheet over the table. vvv) Discussed in brief about both alidades plane alidade and telescopic alidade, spirit level and the use of compass or trough compass in the plane table surveying. www) Checks on closed traverses like check on angular measurements and checks on linear measurements.

	xxx) Description in brief about the orientation by back sighting and orientation by magnetic compass. 42. **Exercise** (5 minutes) – A small practical exercise on how to set up the plane table on the field and how to level it with the help of spirit level.
Closure	40. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 41. Suggested Reading - Video links https://www.youtube.com/watch?v=2EYQDwcizcE&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=12 42. Homework - Write out the difference between the orientation by back sighting and orientation by magnetic compass. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	14. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 15	**Course Name: Surveying-I** **Topic: Methods of plane table surveying.**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: eee. Articulate about all four methods of plane table surveying used. fff. Learn about procedure of setting out the plane table over a station which is on the field. ggg. Illustrate about radiation, resection, traversing and intersection methods in details. hhh. Learn about the orientation principle in the plane table surveying.
Teaching Aids (if any)	v. Pen and white board.
Teaching Development	43. **Introduction** (5 minutes) - Introduce the student's the various accessories of plane table like magnetic compass, needle, alidade, u fork etc. - Introduce them about methods of traversing like chain traversing. - Highlighted about the orientation methods in survey.

	- Basics about the basics and principles of plane table surveying. 44. **Development** (30 minutes) yyy) Discussed in details the principle of parallelism that are the rays drawn from the station to the objects on the paper and parallel lines drawn. zzz) Discussed in detail the size of plane table, material with which it is made, and the process of fixing the sheet over the table. aaaa) Discussed in brief about both alidades plane alidade and telescopic alidade, spirit level and the use of compass or trough compass in the plane table surveying. bbbb) Checks on closed traverses like check on angular measurements and checks on linear measurements. cccc) Description in brief about the orientation by back sighting and orientation by magnetic compass. 45. **Exercise** (5 minutes) – A small practical exercise on how to set up the plane table on the field and how to level it with the help of spirit level.
Closure	43. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 44. Suggested Reading 45. Video links https://www.youtube.com/watch?v=GGlaqd17Ctg&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=34 46. Homework - Write out the difference between the orientation by back sighting and orientation by magnetic compass. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	15. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 16	**Course Name: Surveying-I** **Topic: Leveling instruments, temporary and permanent adjustments**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: iii. Learn about all the concepts of reduced levels, line of collimation, axis of

	bubble tube, axis of telescope. jjj. Learn about temporary adjustments of levels like fixing of levels, approximate levelling, levelling by foot screws. kkk. Illustrate about focussing by eye-piece and object glass and its functions. lll. Learn about various types of levelling operations.
Teaching Aids (if any)	w. Pen and white board. x. Website of survey department of India.
Teaching Development	46. **Introduction** (5 minutes) - Introduce the student's about simple levelling, differential levelling, longitudinal profiling, cross section levelling, and check levelling. - Introduce them about the fly levelling operations in details. - Highlighted about the orientation methods in survey. - Basics about the basics and principles of levelling operations. 47. **Development** (30 minutes) dddd) Discussed in detail about the permanent adjustment of level and the fundamental lines like the line of collimation, axis of bubble tube, the vertical axis, and the axis of telescope. eeee) Discussed in detail about the principle of reversal. ffff) Discussed briefly about the several relationships between the lines. gggg) Checks on permanent adjustments of dumpy level with first and second adjustments. hhhh) Description in brief the errors in the levelling and its methods to diminish it. 48. **Exercise** (5 minutes) – A small exercise to set up and learn about the temporary and permanent adjustment in Auto-level.
Closure	47. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 48. Suggested Reading - Video links https://www.youtube.com/watch?v=GGlaqd17Ctg&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=34 49. Homework - Write out the difference between the temporary and permanent adjustments of the level. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	16. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 17	Course Name: Surveying-I Topic: Corrections for Refraction and Curvature	Course No.: CE-303

Objectives	At the end of the lesson the student shall be able to: mmm. Learn about the corrections to be applied in the operations of levelling. nnn. Learn about curvature correction, the concept of level line and line of sight significance. ooo. Illustrate about the subtractive and addition corrections in the operations of curvature and refraction correction. ppp. Learn about various types of levelling operations.
Teaching Aids (if any)	y. Pen and white board. z. Website of survey department of India.
Teaching Development	49. **Introduction** (5 minutes) - Introduce the students about the visible horizontal distances, dip of horizons. - Introduce them about sensitivity of bubble tube and the method to determine the sensitiveness. - Highlighted about the reciprocal levelling operations. - Various problems on reciprocal levelling operations. 50. **Development** (30 minutes) iiii) Discussed in detail about the main principle of equalising back sight and foresight distances with both cases of when the line of collimation is inclined upwards and downwards. jjjj) In curvature correction discussed for the long sights, vertical distances between the line of sight and the level line. kkkk) Calculated the true staff reading with use of observed staff reading and refraction correction. llll) The combined effect of curvature and refraction correction, visible horizon distance calculation in details. mmmm) Various numerical problems on corrections and sensitiveness. 51. **Exercise** (5 minutes) – A man at a position 10 above sea level observes the peak of a hill? The distance between the man and the hill is 80 km. Find the height of the hill?
Closure	50. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 51. Suggested Reading - Video links

	https://www.youtube.com/watch?v=GGlaqd17Ctg&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=34 52. Homework - Write out a short note on reciprocal levelling and a problem on reciprocal levelling is given to them. Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	17. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 18	**Course Name: Surveying-I** **Topic: Computation of areas by trapezoidal and Prismoidal formula**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: qqq. Learn completely about the computation of areas from the field notes. rrr. Learn about different methods like graphical methods and instrumental methods. sss. Illustrate them about the various graphical methods like plotting from field notes, from plotted plan like entire area or boundary area. ttt. Boundary area methods like Mid-ordinate rule, average ordinate rule, trapezoidal rule, prismodal rule.
Teaching Aids (if any)	aa. Pen and white board. bb. Website of survey department of India.
Teaching Development	52. **Introduction** (5 minutes) - Introduce the students the methods of computation of areas by different methods, - Problems on computing area from the field notes. - Computation of area from the plotted plan like considering the whole area, by dividing the area into squares and by drawing parallel lines and converting them to rectangles. - Various problems on reciprocal levelling operations. 53. **Development** (30 minutes) nnnn) Discussing and solving the problems on the boundary area methods: - the mid ordinate rule, the average ordinate rule, the

	trapezoidal rule, the Simpson's rule. oooo) Finding the area by using the values of common distances and sum of mid ordinates. pppp) Calculated about the boundaries between the ends of ordinates which are assumed to form an arc of parabola. qqqq) Discussed with them about finding the area by the coordinate methods in detail. rrrr) Difference between the Trapezoidal rule and Simpson's rule and their limitation. 54. **Exercise** (5 minutes) – A small exercise to find the area by the instrumental methods like use of planimeter in the surveying operations.
Closure	53. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 54. Suggested Reading - Video links https://www.youtube.com/watch?v=GGlaqd17Ctg&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=34 55. Homework - State the trapezoidal rule, what are the considerations and limitations of this rule? - State Simpson's rule. What are the considerations and limitations of this rule? Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	18. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 19	**Course Name: Surveying-I** **Topic: Computation of volumes.**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: uuu. Learn completely about the computation of volumes from the field notes. vvv. Learn about methods and formulae for calculation of cross-sectional area.

	www. Illustrate them about the level section, two level sections, three level sections, side hill two level sections. xxx. Prismoidal correction for trapezoidal or average end area rule. yyy. Learnt in detail about the formulas for calculation for volumes like Trapezoidal rule (Average End area rule) and Prismoidal formula.
Teaching Aids (if any)	cc. Pen and white board. dd. Website of survey department of India.
Teaching Development	55. **Introduction** (5 minutes) - Introduce the students the methods of computation of volumes by different methods, - Problems on computing volumes from the field notes. - Computation of area from the plotted plan like considering the whole area, by dividing the area into squares and by drawing parallel lines and converting them to rectangles. - Various problems on volume calculation by contour maps. 56. **Development** (30 minutes) ssss) Discussing and solving the problems on two level section, three level section, level section, side hill two level sections in detail. tttt) Finding the volumes by Trapezoidal and Simpson's rule in details with examples. uuuu) Calculated about the boundaries between the ends of ordinates which are assumed to form an arc of parabola. vvvv) Discussed with them about finding the volumes by the coordinate methods in detail. wwww) Difference between the Trapezoidal rule and Simpson's rule and their limitation. 57. **Exercise** (5 minutes) – When would the prismoidal corrections be applied and the meaning of lead and lift operation.
Closure	56. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 57. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=37 58. Homework - Draw the mass haul diagram and what is the use of this diagram. - Spend 5 minutes to wrap up and consolidate the learning.
Evaluati	19. Reflective Questions (What, Why, Who?). Allow students to answer and

on	discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 20	**Course Name: Surveying-I** **Topic: Various parts, axis of transit and other technical terms**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: zzz. Learn about measuring horizontal angles, vertical angles and deflection angles. aaaa. Learn about magnetic bearings, measuring the horizontal distances between two points. bbbb. Illustrate them about finding the vertical height of an object, finding the difference of elevation between various points. cccc. Learn in details about ranging the line. dddd. Learnt in detail about several basic technical terms related to theodolite traversing.
Teaching Aids (if any)	ee. Pen and white board. ff. Website of survey department of India.
Teaching Development	58. **Introduction** (5 minutes) - Introduce the students about centring the theodotile exactly over a station mark by means of plumb-bob. - Several basic definitions like transiting, face left, face right, telescope normal, telescope inverted, changing the face of theodolote, swinging the telescope etc. - Reading line of collimation, axis of telescope, axis of bubble tube, vertical axis, and horizontal axis. - Introduce them about the temporary and permanent adjustments of telescope, least count of vernier scale, diaphragm, sensitiveness of bubble tube etc. 59. **Development** (30 minutes) xxxx) Discussing in details about various parts essential of vernier transit theodolite with complete diagram. yyyy) Finding the readings to be taken on vernier theodolite , reading the least counts of main scale, vernier scale. zzzz) Reading the micrometer theodolite in detail. aaaaa) Discussed with them about the temporary adjustments of theodolite with setting the theodolite over the stations. bbbbb) Discussing with them about some of the modern theodolite used in the survey industry like geodetic and astronomical surveys which require high degree of precesion. 60. **Exercise** (5 minutes) –

	Make the complete diagram of vernier transit theodolite and discussion of its parts.
Closure	59. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 60. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudl12hc85KwBJOY1uLYHwfhuBq&index=37 61. Homework - Explain the difference between wild T-2 theodolite and Wild T-3 theodolite. - Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	20. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 21	**Course Name: Surveying-I** **Topic: Measurement of horizontal and vertical angles**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: eeee. Learn about direct methods of measuring horizontal angles. ffff. Learn about two methods of measuring horizontal angles in details like repetition method and reiteration method. gggg. Illustrate them about measuring the vertical angle in details and also the measurement of deflection angles. hhhh. Learnt in detail about measuring horizontal distance by stadia method. iiii. Methods of traversing like included angle method, deflection angle method and fast angle method.
Teaching Aids (if any)	gg. Pen and white board. hh. Website of survey department of India.
Teaching Development	61. **Introduction** (5 minutes) - Introduce the students about different methods of traversing. - Ranging and extending a line in surveying.

	- Explanation on fast needle method to measure the magnetic bearings and lengths of traverse legs. - Introduce them about checks in closed and open traverse and sources of error in theodolite with instrumental errors and personal errors. 62. **Development** (30 minutes) ccccc) Discussing in details about the closing errors and its limitations. ddddd) Computation of latitude and departure details in theodolite surveys and calculating the values of northing, southing, easting and westing. eeeee) Finding the values of consecutive coordinates and independent coordinates. fffff) Discussed with them about how to balance the traverse and find the error in it. ggggg) Discussing with them the Bowditch's rule, transit rule and third rule and their respective adjustments. 63. **Exercise** (5 minutes) – An example on adjustments by Bowditch's rule and transit rule.
Closure	62. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 63. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=37 - 64. Homework - Explain the correction to northing, easting, southing and westing of any side of traverse by third rule? - Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	21. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 22	Course Name: Surveying-I Topic: Theodolite traverse - different methods of running theodolite traverses.	Course No.: CE-303

Objectives	At the end of the lesson the student shall be able to: jjjj. Learn about calculation of traverse area from the coordinates, the latitude and double meridian distance and the departure and total latitudes. kkkk. Learn about whole procedure for traverse survey with theodolite like reconnaissance, marking the stations, measurement of interior angles, measurement of magnetic bearing and correction of measured angles. llll. Illustrate them about gale's table preparation from the recorded data. mmmm. Learnt in detail about the correction to latitudes by third rule. nnnn. Location of interior details like the transit and tape method and the plane table method.
Teaching Aids (if any)	ii. Pen and white board. jj. Website of survey department of India.
Teaching Development	64. **Introduction** (5 minutes) - Introduce the students about the methods of calculation of traverse area. - Ranging and extending a line in surveying. - Explanation on reconnaissance, marking the stations, measurement of interior angles, measurement of magnetic bearing and correction of measured angles. - Introduce them about the correction to latitudes and departures by the third rule. 65. **Development** (30 minutes) hhhhh) Discussing in details the transit and tape method, in which theodolite is set up at the transit station (i.e. the traverse station) and the angle between the traverse leg and the object is measured. iiiii) Computation of location of interior details by the plane table method in which plotted on a drawing sheet according to the Gale's table. jjjjj) Finding how to plot the traverse and the points that should be taken care of while plotting the traverse. kkkkk) Working out the various problems on latitude and departure with some incomplete datas. lllll) Discussing with them the Bowditch's rule, transit rule and third rule and their respective adjustments. 66. **Exercise** (5 minutes) – An example of gale's table is being worked out.
Closure	65. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 66. Suggested Reading

	- Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=37 67. Homework - In an open traverse abcde, it is required to fix the midpoint of the line joining A and E. Find the length and bearing of that point from the station C, when the records of the traverse are given? - Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	22. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 23	**Course Name: Surveying-I** **Topic: Omitted measurements, errors in theodolite survey**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: oooo. Learn about permanent adjustment of theodolite that consists of several fundamental lines. pppp. Learn about the fundamental lines of theodolite that are the vertical axis, the axis of the plate level, the line of collimation, the horizontal axis or trunnion axis, the bubble line of the altitude level. qqqq. Illustrate them about the desired relationships between the fundamental lines of the telescope. rrrr. Adjustments of the vernier transit theodolite, adjustments of vertical hair and horizontal hairs.
Teaching Aids (if any)	kk. Pen and white board. ll. Website of survey department of India.
Teaching Development	67. **Introduction** (5 minutes) - Introduce the students about the basic permanent adjustments of the theodolite. - Ranging and extending a line in surveying. - Explanation on various axis of the telescope. - Introduce them about the adjustments of theodolite, vertical hairs and horizontal hairs. 68. **Development** (30 minutes) mmmmm) Discussing in details the first adjustment to make the axis of plate level perpendicular to the vertical axis. nnnnn) To make the line of collimation coincide with the optical axis of the telescope, first the horizontal hair and then the vertical hair which

	are adjusted? ooooo) Trigonometric levelling to find the height of objects on the ground like when the base of the object is accessible and when the base of the object is not accessible. ppppp) Working out the various problems on latitude and departure with some incomplete datas. qqqqq) Discussing with them the Bowditch's rule, transit rule and third rule and their respective adjustments. 69. **Exercise** (5 minutes) – Explained the procedure for traverse survey with theodolite.
Closure	68. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 69. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=37 70. Homework - Discuss some of the modern theodolite and also explain consecutive coordinates and independent coordinates? - Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	23. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents

Lesson Plan No. 24	**Course Name: Surveying-I** **Topic: Trigonometric levelling**	**Course No.: CE-303**

Objectives	At the end of the lesson the student shall be able to: ssss. Learn about the basics of trigonometric levelling and its methods. tttt. Learn about terrestrial refraction, coefficient of refraction, uuuu. Illustrate them about the desired relationships between the fundamental lines of the telescope. vvvv. Adjustments of the vernier transit theodolite, adjustments of vertical hair and horizontal hairs.
Teaching Aids (if any)	mm. Pen and white board. nn. Website of survey department of India.
Teaching Development	70. **Introduction** (5 minutes) - Introduce the students about the basic permanent adjustments of the theodolite.

	- Ranging and extending a line in surveying. - Explanation on various axis of the telescope. - Introduce them about the adjustments of theodolite, vertical hairs and horizontal hairs. 71. **Development** (30 minutes) rrrrr) Discussing in details the first adjustment to make the axis of plate level perpendicular to the vertical axis. sssss) To make the line of collimation coincide with the optical axis of the telescope, first the horizontal hair and then the vertical hair which are adjusted? ttttt) Trigonometric levelling to find the height of objects on the ground like when the base of the object is accessible and when the base of the object is not accessible. uuuuu) Working out the various problems on latitude and departure with some incomplete datas. vvvvv) Discussing with them the Bowditch's rule, transit rule and third rule and their respective adjustments. 72. **Exercise** (5 minutes) – Explained the procedure for traverse survey with theodolite.
Closure	71. Summarize the Lesson Learning Outcomes and get affirmation from students on these. 72. Suggested Reading - Video links https://www.youtube.com/watch?v=vDUu3IKQjr0&list=PLHBZBnEudI12hc85KwBJOY1uLYHwfhuBq&index=37 73. Homework - Discuss some of the modern theodolite and also explain consecutive coordinates and independent coordinates? - Spend 5 minutes to wrap up and consolidate the learning.
Evaluation	24. Reflective Questions (What, Why, Who?). Allow students to answer and discuss. Spend 5 minutes to evaluate student assimilation of the lesson contents