FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2022 TO YEAR 2023

Programme Code: DILT

Programme Name: Certificate/ Diploma Instrumentation and Laboratory Technician

(Semester I-II)

Examinations: 2022-23

Department of Physics

Khalsa College, Amritsar

(An Autonomous College)

S.NO.	PROGRAMME OBJECTIVES
1.	To undergo training in all laboratory instruments in Physics, basic chemical lab practices and techniques.
2.	To evaluate the process and outcomes of an experiment quantitatively and qualitatively.

S.NO.	PROGRAMME SPECIFIC OUTCOMES (PSOs)
PSO-1	To plan and perform experiments and practices.
PSO-2	To know about the basics of mechanical, optical, electrical and electronic Instruments and chemical labs.
PSO-3	To measure length, time, temperature, volume etc. using sophisticated instruments.
PSO-4	To know about the basic circuits in domestic electricity and in electronics.
PSO-5	To maintain the physics and chemistry lab and handling of physics instruments, Chemicals and Glass wares.

ELIGIBILITY: A candidate who has passed 10+2 Arts/Commerce/Science examination from recognized board or any other examination considered equivalent by the GNDU with 35% marks is eligible to apply (subject to change).

COURSE DURATION: 1 Year

COURSE SCHEME							
SEMESTER - I							
Course Code	**Course Name**	**Hours/Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
DIL-111	Mechanical Instruments	3	75	-	25	100	3-4
DIL-112	Electrical Instruments-I	3	75	-	25	100	5-6
DIL-113	Electronic Instruments-I	3	75	-	25	100	7-8
DIL-114	Mechanics Lab	4.5	-	75	25	100	9-10
DIL-115	Electrical and Electronics Lab-I	4.5	-	75	25	100	11-12
						500	

SEMESTER - II							
Course Code	**Course Name**	**Hours/Week**	**Max. Marks**				**Page No.**
			Th	**Pr**	**IA**	**Total**	
DIL-121	Optical Instruments	3	75	-	25	100	13-14
DIL-122	Electrical Instruments-II	3	75	-	25	100	15-16
DIL-123	Chemical Lab Safety and Techniques	3	75	-	25	100	17-18
DIL-124	Optics and Electrical Lab	4.5	-	75	25	100	19-20
DIL-125	Basic Chemical Lab	4.5	-	75	25	100	21-22
						500	

SEMESTER–I

DIL-111

Mechanical Instruments

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives:

The main objective of this course is to make students familiar with the mechanical measuring systems, and the standard measurement methods. It further aims to make them to understand the basic measurement systems in the real time applications.

Course Contents:

UNIT-I

Length measurements: Vernier Caliper: Calculating the least Count, Zero error, Reading a vernier Caliper, Vernier scale, Main scale, Application of vernier Caliper.

Screw Gauge: Principle of screw gauge, Pitch, Least Count, zero error, Reading a screw gauge, Application of Screw gauge.

Spherometer: Working principle, Parts of spherometer, Principle of operation, Least count, Pitch, Applications of spherometer.

UNIT-II

Time and Mass measurements: Stop watch and Digital timer, Spring balance, Physical balance, Digital Balance.

Temperature measurements: Mercury Thermometer, Ethanol thermometer, Digital Thermometer

Books Prescribed:

1. Practical Physics, C.L. Arora, S. Chand & Co

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Know about the least count and zero error of various instruments.
CO2	Know the working principle of vernier caliper, screw gauge and spherometer.
CO3	Understand about the mass measuring instruments.
CO4	Understand the working of stop watch and digital watch.
CO5	Know the difference between the various thermometers.

SEMESTER–I

DIL-112

Electrical Instruments-I

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The objectives of this course are to introduce students to monitor, analyze and control an electrical system, to understand students how different types of meters work and their construction, to introduce students to use electric tools necessary for electrical projects.

Course Contents:

UNIT-I

Analog Meters: Introduction, principle, construction and applications of permanent magnetic moving coil meter (PMMC), AC Ammeter, AC Voltmeter, DC Ammeter, DC voltmeter, Ohmmeter

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

UNIT-II

Electrical Components:

Resistive Components: Rheostat, Resistance coil, Resistance box, Keys

Reactive Components: Capacitors, Inductors, transformers, series and parallel circuits.

DC Bridge: Wheatstone bridge, Post office box, Meter Bridge and Potentiometer.

Books Prescribed:

1. Electrical Engineering by B. L. Thareja
2. Electrical and Electronic measurements by A. K. Sawhney

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Understand the working of different analog meters.
CO2	Learn about the multimeter and its specifications. and to measure different parameters.
CO3	Measure DC voltage, DC current, AC voltage, AC current and resistance using multimeter.
CO4	Know about the resistive and reactive components.
CO5	Understand the different DC bridges.

SEMESTER–I

DIL-113

Electronic Instruments-I

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The objectives of this course are to explain the basic concepts of semi-conductor diodes, their current-voltage relationships and applications in rectifiers, to explain the basics and applications of oscilloscope.

Course Contents:

UNIT-I

Semiconductor Diodes: Semiconductors, Extrinsic and Intrinsic semiconductors, PN-Junction diode, V-I Characteristics of a PN-Junction Diode, The Ideal Diode, Use of Diodes in Rectifiers. Zener diode, Characteristics of Zener diode, Zener diode as voltage regulator.

UNIT-II

Rectifiers: Circuit diagrams of Half wave rectifier, full wave rectifier, relationship between D.C output voltage and A.C input voltage, rectification efficiency and ripple factor for rectifier circuits, filter circuits- shunt capacitor, series inductor, working of the filter.

Basics of Oscilloscope: Analog and digital oscilloscopes, Self-Testing, vertical and horizontal sensitivity, Identification of various types of pulses, Voltage, time and frequency measurement.

Books Prescribed:

1. Basic Electronics and Linear Circuits by N.N. Bhargava, D.C. Kulshreshtha and S.C. Gupta.
2. Foundations of Electronics by D. Chatophadhyay, P.C. Rakshit, B. Saha and N.N. Purkit.
3. Basic Electronics by D.C. Tayal (Himalaya Pub.)
4. Principles of Electronics by V.K. Mehta, Rohit Mehta (S. Chand Publications)

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Identify the various parameters that are measurable in electronic instrumentation.
CO2	Know about the basics of semiconductors and diodes.
CO3	Understand the applications of diodes in rectifiers.
CO4	Learn about the analog and digital oscilloscopes.
CO5	Measure Voltage, Time and frequency using oscilloscopes.

SEMESTER–I

DIL-114

Mechanics Lab

(PRACTICAL)

Credit Hours (per week): 4.5

Time: 3 Hours **Maximum Marks: 100**

(Practical Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

General Guidelines for Practical Examination:

I. The distribution of marks is as follows:

i) One experiment: **40 Marks**

ii) Brief Theory: 1**0 Marks**

iii) Viva–Voce: **10 Marks**

iv) Record (Practical file): **15 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 6 experiments out of which an examinee will mark 4 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: The main objective of this course is to instill the basic experimental skills in the students. This course will provide the hands on experience to the basic instruments like vernier caliper, screw gauge and screw gauge, spring balance and thermometer.

Course Contents:

1. To measure diameter and volume of a small spherical/cylindrical body using Vernier Caliper.
2. To measure internal diameter and depth of a given beaker using Vernier Caliper and hence find its volume.
3. To measure dimension of a given regular body of known mass using a Vernier Caliper and hence find its density.
4. To measure diameter of a given wire using screw gauge.
5. To measure thickness of a given sheet using screw gauge

6. To determine the volume of a irregular lamina using screw gauge
7. To determine Least count and pitch of a spherometer.
8. To determine the mass of two different objects using spring balance.
9. To determine the temperature of various bodies using mercury thermometer.
10. To determine the temperature of various bodies using ethanol thermometer.
11. To study variation of time period of a simple pendulum of a given length by taking bobs of same size but different masses.

Books Prescribed:

1. Practical Physics, C.L. Arora, S. Chand & Co

Course Outcomes	**On completing the course, the students will be able to:**
CO1	measure diameter, volume, density of a small spherical/cylindrical body ,given beaker and regular body using Vernier Caliper.
CO2	measure diameter of a given wire, thickness of a given sheet and volume of a irregular lamina using screw gauge
CO3	determine radius of curvature of a given spherical surface by a spherometer.
CO4	determine the mass of two different objects using spring balance.
CO5	determine the temperature of various bodies using mercury and ethanol thermometer.

SEMESTER–I

DIL-115

Electrical and Electronics Lab-I

(PRACTICAL)

Credit Hours (per week): 4.5

Time: 3 Hours **Maximum Marks: 100**

(Practical Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

General Guidelines for Practical Examination:

I. The distribution of marks is as follows:

i) One experiment: **40 Marks**

ii) Brief Theory: 1**0 Marks**

iii) Viva–Voce: **10 Marks**

iv) Record (Practical file): **15 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 6 experiments out of which an examinee will mark 4 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: Course objective of this subject is to follow the pragmatic way of learning and instill the basic experimental skills in the students. This will provide practical knowledge in dealing with meter bridge, multimeter, pn diode, zener diode, rectifier, CRO etc.

Course Contents:

1. To set up meter bridge to find resistance of a given wire.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To identify a diode, an LED, a resistor and a capacitor from mixed collection of such items.
4. Use of multimeter to see the unidirectional flow of current in case of a diode and an LED and check whether a given electronic component is in working order.

5. To set up the apparatus for studying forward and reverse bias characteristics of a p-n junction diode
6. To setup the apparatus for measurement of reverse saturation current in p-n-junction diode at various temperatures.
7. To set up the apparatus for studying characteristics of a Zener diode.
8. To set up the apparatus to study the stabilization of output voltage of a power supply with Zener diode as function of input voltage.
9. To set up the apparatus for half wave and full wave rectifier circuits.
10. Study the working of CRO and display AC and DC signals.
11. Operation of Smart board.
12. Operation of Multimedia.

Books Prescribed:

1. Practical Physics Vol. III, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications.
2. Practical Physics, C.L. Arora, S. Chand & Co

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Setup the apparatus to find resistance of a given wire using meter bridge
CO2	Measure various parameters using multimeter and identify a diode, an LED, a resistor and a capacitor from mixed collection of such items.
CO3	Set up the apparatus for studying characteristics of a p-n junction diode and zener diode.
CO4	Study the working of CRO and display AC and DC signals.
CO5	Operate smart board and multimedia.

SEMESTER–II

DIL-121

Optical Instruments

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

- **Course Objectives:** The objectives of this course are to acquire skills allowing the student to identify and apply formulas of optics and wave optics, to identify and illustrate physical concepts and terminology used in optics and to be able to explain them in appropriate detail, to acquire skills allowing the student to organize and plan simpler laboratory course experiments.

Course Contents:

UNIT-I

Optics: Laws of reflection and refraction, Plane mirror, spherical mirrors, Prisms, Lenses, Sources of light: Incandescent sources and discharge lamps.

Wave Optics: Qualitative analysis of Newton's rings and Michelson interferometer, Diffraction gratings and their resolving power.

UNIT-II

Lasers: Properties of laser beam, Components of Laser, Types of Laser: He-Ne Laser, diode laser.

Optical Instruments: Microscope: Simple microscope, Compound microscope, Telescope, Spectrometer

Books Prescribed:

1. Fundamentals of Optics, F.A. Jenkins and Harvey E White,(Mcgraw Hill) 4th edition,2001
2. Optics, Ajoy Ghatak,(McMillan Indian) 2nd edition, 7th reprint, 1997
3. Laser Fundamentals, W.T. Silfvast (Foundation Books), New Delhi, 1996
4. Laser and Non-Liner Optics, B.B. Laud (New Age Pub.) 2002
5. Laser, Svelto, (Plenum Pres) 3rd edition, New York

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Describe the laws of reflection and refraction.
CO2	Understand the qualitative analysis of Newton's rings and Michelson interferometer.
CO3	Understand the diffraction gratings and their resolving power.
CO4	Describe the properties of laser and its types.
CO5	Understand the basics of microscopes, telescope and spectrometer.

SEMESTER–II

DIL-122

Electrical Instruments-II

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The objectives of this course are to make the student familiar about the earth concept, grounding, shielding and installation of switches, sockets, domestic fitting etc., to study testing devices like phase tester, line tester and Continuity Tester.

Course Contents:

UNIT-I

Grounding: Earth Concept, Shock hazard protection using Earth ground, Basic grounding practice.

Shielding: Guidelines, Protection from Electrostatic Discharge

Study of Domestic Circuits: Installation of Switches, Sockets, Brackets, MCBs (single pole and double pole), Cables and wires, Domestic Fitting**.**

UNIT-II

Testing Devices: Study of Test Lamp, Line Tester, Phase Tester and Continuity Tester.

AC Bridge: Maxwell Bridge, Wein's Bridge, Anderson's Bridge.

Books Prescribed:

1. Electrical Engineering by B. L. Thareja
2. Electrical and Electronic measurements by A. K. Sawhney

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Understand the earth Concept, shock hazard protection using Earth ground and basic grounding practice.
CO2	Know how to Install switches, Sockets, Brackets, MCBs (single pole and double pole) and Cables and wires.
CO3	Understand the basics of Maxwell Bridge, Wein's Bridge, Anderson's Bridge.
CO4	Examine various real life situations in domestic or industrial scenario where measurements of electrical quantities are essential.
CO5	Choose the proper type and specification of measuring procedure and measuring instruments for different industrial/commercial/domestic applications

SEMESTER–II

DIL-123

Chemical Lab Safety and Techniques

(THEORY)

Credit Hours (per week): 3

Time: 3 Hours **Total Hours: 45**

Maximum Marks: 100

(Theory Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

Note for paper setter and students:

1. **There will be three sections.**
2. **Section A carries 15 marks and is compulsory consisting of seven short answer type questions of 3 marks each covering the whole syllabus. The candidate will have to attempt five questions in section A.**
3. **Sections B and C will be set from units I & II respectively and will consist of four questions of 15 marks each from the respective unit. The candidates are required to attempt two questions from each of these sections.**
4. **Scientific calculator is allowed.**

Course Objectives: The main objectives of this course are to make the students aware about the safe handling of chemicals, personal protection in lab, methods of storing chemicals, weighing the salts, preparation of solutions of solids, liquids, volatile and non-volatile substances.

Course Contents:

UNIT-I

Good lab practices

General Safety, Safe Handling of Chemicals and Glass wares, working in BioSafety areas, Hazards associated with chemicals and chemical waste, Personal protection and protective clothing for handling of potentially hazardous chemicals, Fire prevention and fire control in chemical industries, waste disposal and management.

Maintenance of Lab

Method of storing chemicals, reading of labels (storage code e.g. general, flammable, health

hazard, oxidizing agent, corrosive, purity grade, alternate names for the chemical, solvents and glassware, common apparatus used in chemistry lab.

UNIT-II

Chemical & physical changes, proper use of the analytical balance, Weighing and measuring of salts and chemicals,correct pipetting and volume-transfer techniques, and wet chemistry techniques. filtration, refluxing,precipitation, recrystallization

Volumetric Analysis: Acid, base, salt, Atomic Weight, Molecular Weight, Equivalent Weight, Normality, Molarity, Molality, ppm, ppb, density, Specific gravity, Weight - volume relationship. Preparation of solutions of solids, liquids, volatile, non-volatile, etc. substances. Preparation of standard & primary standard solutions.

Books Prescribed:

1. Svehla, G: Vogel's qualitative inorganic analysis, 7th Edition, Prentice Hall, 1996
2. Gordon, A. J; Ford, R. A. The Chemist's Companion: A Handbook of Practical Data, Techniques,and References, Wiley-interscience, 1972.
3. Hein, M; Peisen, J.P, Miner, R. L, Foundations of College Chemistry in the Laboratory, John Wiley and Sons, 2011
4. Vogel, A. I, Elementary Practical Organic Chemistry: Small Scale Preparations Part 1, 2nd edition,2010

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Handle the Chemicals and Glass wares safely.
CO2	Know about the fire prevention and fire control in chemical industries.
CO3	Method of storing chemicals and reading of labels
CO4	Make proper use of the analytical balance and measuring of salts and chemicals.
CO5	prepare the solutions of solids, liquids, volatile and non-volatile substances, standard & primary standard solutions.

SEMESTER–II

DIL-124

Optics and Electrical Lab

(PRACTICAL)

Credit Hours (per week): 4.5

Time: 3 Hours **Maximum Marks: 100**

(Practical Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

General Guidelines for Practical Examination:

I. The distribution of marks is as follows:

i) One experiment: **40 Marks**

ii) Brief Theory: 1**0 Marks**

iii) Viva–Voce: **10 Marks**

iv) Record (Practical file): **15 Marks**

II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 6 experiments out of which an examinee will mark 4 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: The course objective is to make the student familiar with optical instruments and methods. The student will also have the opportunity to learn how to use and calibrate optical measuring equipment and identify sources of error and uncertainty in practical work.

Course Contents:

1. To set up the apparatus for finding the value of v for different values of u in case of a concave mirror.
2. To set up the apparatus for finding the focal length of a convex lens by plotting graphs between u and v or between 1/u and I/v.
3. To set up the apparatus for finding the focal length of a convex mirror, using a convex lens.
4. To set up the apparatus for finding the focal length of a concave lens, using a convex lens.

5. To set up the apparatus for finding the refractive index of glass slab using travelling microscope.
6. To set up the apparatus for finding the wavelength of He-Ne Laser using single slit/N-slit diffraction pattern.
7. Use of multimeter to (i) identify base of transistor, (ii) distinguish between npn ad pnp type transistors, (iii) Check whether a transistor is in working order.
8. Installation and study of Energy meter
9. Study and verification of Basic Gates (AND,OR & NOT).

Books Prescribed:

1. Practical Physics Vol. II, T.S. Bhatia, Gursharan Kaur, Iqbal Singh, Vishal Publications.
2. Practical Physics, C.L. Arora, S. Chand & Co

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Find the local length of a convex mirror and concave mirror.
CO2	Set up travelling microscope.
CO3	Determine the wavelength of He-Ne Laser using single slit/N-slit diffraction pattern.
CO4	Study the household Energy meter.
CO5	Verify the Basic Gates (AND,OR & NOT)

SEMESTER–II

DIL-125

Basic Chemical Lab

(PRACTICAL)

Credit Hours (per week): 4.5

Time: 3 Hours **Maximum Marks: 100**

(Practical Marks: 75+ Internal Assessment: 25)

Pass Marks: 35%

General Guidelines for Practical Examination:

I. The distribution of marks is as follows:

i) One experiment: **40 Marks**

ii) Brief Theory: 1**0 Marks**

iii) Viva–Voce: **10 Marks**

iv) Record (Practical file): **15 Maprks**

II. There will be one sessions of 3 hours duration. The paper will have one session. Paper will consist of 6 experiments out of which an examinee will mark 4 experiments and one of these is to be allotted by the external examiner.

III. Number of candidates in a group for practical examination should not exceed 12.

IV. In a single group no experiment be allotted to more than three examinee in any group.

Course Objectives: Course objective of this subject is to follow the pragmatic way of learning and instill the basic experimental skills in the students. This will provide practical knowledge in dealing with chemical glasswares, measuring volume of liquids, preparation of standard solutions and water analysis.

Course Contents:

1. Maintaining a laboratory notebook.
2. Cleaning of glassware
3. Measuring volume of liquids

   Using Graduated Cylinder, Using Burette, Using Pipette, Using Measuring Flask
4. Weighing Techniques with Analytical Balance, Weight Box Including Fractional Weights and Riders. Setting of a Chemical Balance and Weighing

5. Preparation of standard solutions and determination ofthe concentration and percentagepurity of
   0.1 M NaOH, 0.1 N Hypo solution, 0.1 M Oxalic acid, 0.5 N potassium dichromate solution0.2
6. Preparation of dilute solutions of known concentration of sulphuric acid, hydrochloric acidand nitric acid. (Dilution should be carried out strictly under the supervision of a teacher).
7. Prepare the Ethylene diamine tetra acetic acid (EDTA) solution & indicator and titration withEDTA.
8. Determination of optical rotation of sugar solution using polarimeter
9. Water analysis 1.Hardness 2.Chloride 3.Total dissolved solid (TDS) 4. Alkalinity

Books Prescribed:

1. Svehla, G: Vogel's qualitative inorganic analysis, 7th Edition, Prentice Hall, 1996
2. Gordon, A. J; Ford, R. A. The Chemist's Companion: A Handbook of Practical Data, Techniques,and References, Wiley-interscience, 1972.
3. Hein, M; Peisen, J.P, Miner, R. L, Foundations of College Chemistry in the Laboratory, John Wiley and Sons, 2011
4. Vogel, A. I, Elementary Practical Organic Chemistry: Small Scale Preparations Part 1, 2nd edition,2010

Course Outcomes	**On completing the course, the students will be able to:**
CO1	Maintain a laboratory notebook and learn about cleaning of glassware.
CO2	Prepare the standard solutions and determine the concentration and percentagepurity of different solutions.
CO3	Prepare the dilute solutions of known concentration of sulphuric acid, hydrochloric acidand nitric acid.
CO4	Determine of optical rotation of sugar solution using polarimeter
CO5	Analyse the Hardness, Total dissolved solid (TDS) and Alkalinity of water.