

BARGAON INSTITUTE OF TECHNOLOGY

DISCIPLINE:	All Branches	SEMESTER:	1st / 2nd
SUBJECT:	APPLIED CHEMISTRY LAB	COURSE CODE:	PR 3
ACADEMIC PERIOD:	FROM: _____ TO: _____	FACULTY NAME:	_____
TOTAL PERIODS:	64 Periods	PERIODS / WEEK:	04 / Week (32 Weeks)
PROGRESSIVE ASSESSMENT:	25 Marks	FINAL EXAM:	25 Marks
EXAM DURATION:	2 Hours	NO. OF CREDITS:	1 Credit

COURSE OUTCOMES (COS)

- CO 1:** Explain various methods of volumetric analysis i.e., Redox, Iodometric, complexometric, Neutralization etc. and use of conductivity meter for measurement of conductance of water sample.
- CO 2:** Apply the use of internal and external indicators and their comparison for redox titrations and mechanisms of iodometric titrations and use of double indicator method in a single titration.
- CO 3:** Estimate the % values of moisture, volatile matter, ash and carbon of fuel by Proximate analysis and instrument handling.
- CO 4:** Analyze the various water quality parameters viz. BOD, COD, DO, Chlorine, TDS, etc. of the sample water.
- CO 5:** Estimate the properties of lubricants viz. Flash & fire point, viscosity, cloud & pour point and their significance.

LESSON DELIVERY PLAN

SL. NO.	WEEK	CLASS DATE	NO. OF CLASS / DAY	TOPICS PLANNED TO BE COVERED	SIGNATURE
01	01			Course Orientation, Lab Safety Guidelines, Introduction to Volumetric & Instrumental apparatus.	
				Volumetric Analysis Basics: Concept of standard solutions, primary vs secondary standards, normality & molarity calculations.	
02	02			Exp 1: Preparation of standard solution of oxalic acid (0.1N / 0.1M).	
				Exp 1 Continued: Preparation of standard solution of potassium permanganate (KMnO ₄).	
03	03			Exp 2: Determination of strength of given sodium hydroxide (NaOH) solution by titrating against standard oxalic acid solution.	
				Exp 2 Continued: Theory and mechanism of phenolphthalein indicator in neutralization titrations.	
04	04			Exp 3: Standardization of KMnO ₄ solution using standard oxalic acid solution.	
				Exp 3 Continued: Determination of percentage of iron present in given Hematite ore by KMnO ₄ solution.	
05	05			Exp 4: Iodometric estimation of copper in the given copper pyrite ore (Part 1: Principles & Reactions).	
				Exp 4 Continued: Iodometric estimation of copper in given copper pyrite ore (Part 2: Titration & Calculations).	
06	06			Exp 5: Volumetric estimation of total acid number (TAN) of given oil sample.	
				Exp 5 Continued: Calculations and significance of Acid Value / TAN in industrial lubricants.	
07	07			Exp 6 (a): Estimation of Total Hardness of given water sample using standard EDTA solution (Complexometric Titration).	
				Exp 6 (a) Continued: Calculations of hardness in terms of CaCO ₃ equivalents using EBT indicator.	

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08	08			Exp 6 (b): Determination of Alkalinity of given water sample using 0.01M sulphuric acid solution.	
				Exp 6 (b) Continued: Phenolphthalein & Methyl Orange alkalinity calculations (Double indicator method).	
09	09			Exp 7 (a): Proximate analysis of coal — Gravimetric estimation of moisture content in given coal sample.	
				Exp 7 (a) Continued: Estimation of volatile matter in given coal sample using muffle furnace.	
10	10			Exp 7 (b): Gravimetric estimation of ash content in given coal sample.	
				Exp 7 Continued: Calculation of fixed carbon content and reporting Proximate Analysis results.	
11	11			Exp 8: Instrumental Analysis: Determination of conductivity of given water sample using Conductivity Meter.	
				Exp 8 Continued: Calibration of conductivity meter and temperature compensation effects.	
12	12			Exp 9: Determination of Iron content in given cement sample using Colorimeter.	
				Exp 9 Continued: Preparation of standard curve (Beer-Lambert's Law) for colorimetric estimation.	
13	13			Exp 10: Determination of calorific value of solid or liquid fuel using Bomb Calorimeter (Theory & Setup).	
				Exp 10 Continued: Operation of Bomb Calorimeter and calculation of Higher & Lower Calorific Values (HCV/LCV).	
14	14			Exp 11: Determination of viscosity of lubricating oil using Redwood Viscometer No. 1 / No. 2.	
				Exp 11 Continued: Effect of temperature on viscosity and Determination of Viscosity Index.	
15	15			Exp 12: Determination of flash and fire point of lubricating oil using Abel's flash point apparatus.	
				Exp 12 Continued: Determination of flash point using Pensky-Martens / Cleveland apparatus & safety implications.	
16	16			Mid-Term Lab Evaluation / Practical Review Session on Experiments 1 to 12.	
				Performance Assessment & Lab Record Verification - Part 1.	
17	17			Exp 13: Verification of the first law of electrolysis of copper sulfate using copper electrodes.	
				Exp 13 Continued: Calculation of Electrochemical Equivalent (ECE) of copper.	
18	18			Exp 14: Construction and measurement of emf of electrochemical cell (Daniel cell).	
				Exp 14 Continued: Nernst equation verification and electrode potential calculations.	
19	19			Exp 15: Determination of amount of dissolved oxygen (DO) present in a water sample (Winkler's Method).	
				Exp 15 Continued: Significance of DO in aquatic life and water quality monitoring.	
20	20			Exp 16: Determination of amount of Biochemical Oxygen Demand (BOD) present in a water sample.	
				Exp 16 Continued: 5-day incubation procedure and BOD calculation formula.	
21	21			Exp 17: Determination of amount of dissolved chlorine present in a water sample.	
				Exp 17 Continued: Chlorination process monitoring and residual chlorine estimation.	
22	22			Exp 18: Determination of Chemical Oxygen Demand (COD) present in a water sample.	

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				Exp 18 Continued: Back titration procedure for COD calculation using potassium dichromate.	
23	23			Exp 19: Determination of amount of turbidity present in a water sample using Turbidimeter / Nephelometer.	
				Exp 19 Continued: Standard Nephelometric Turbidity Unit (NTU) calibration and measurement.	
24	24			Exp 20: Determination of amount of Total Dissolved Solids (TDS) present in a water sample.	
				Exp 20 Continued: Gravimetric / Digital TDS meter measurement and comparison with drinking water standards.	
25	25			Review of Volumetric Titrations (Exp 1 - Exp 6): Key reactions, indicators, and errors.	
				Review of Fuel & Lubricant Testing (Exp 7, 10, 11, 12): Industrial applications and standards.	
26	26			Review of Water Quality Analysis (Exp 15 - Exp 20): DO, BOD, COD, Chlorine & TDS comparison table.	
				Review of Instrumental & Electrochemical Methods (Exp 8, 9, 13, 14).	
27	27			Practical Skill Assessment Practice: Mock Titrations and Unknown Sample Analysis (Batch A).	
				Practical Skill Assessment Practice: Mock Titrations and Unknown Sample Analysis (Batch B).	
28	28			Micro-Project / Group Assignment Presentations: Water quality analysis of local water sources.	
				Micro-Project / Group Assignment Presentations: Comparative study of commercial lubricant oils.	
29	29			Industrial/Site Visit Exposure Discussion: Applications in thermal power plants, water treatment plants, and railway workshops.	
				MOOCs / Online Virtual Lab Demonstration on advanced chemical instrumentation.	
30	30			Internal Practical Examination & Viva-Voce (Batch A).	
				Internal Practical Examination & Viva-Voce (Batch B).	
31	31			Final Lab Record Verification, Progressive Assessment Marks Finalization & Doubt Clearing.	
				Discussion on End-Semester Practical Examination Pattern & Evaluation Scheme.	
32	32			Final Revision on Volumetric Calculations, Formulae & Indicators.	
				Final Academic Review, Lab Maintenance & Course Wrap-up.	

TEACHING STRATEGIES & PEDAGOGICAL METHODS

- Different methods of teaching and media to be used to attain classroom attention.
- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.
- Micro-projects may be given to group of students for hands-on experiences.
- Encouraging students to visit sites such as Railway station and research establishment around the institution.

REFERENCE BOOKS

- ✓ **Applied Chemistry** by Dr. Anju Rawley (*Download from <https://ekumbh.aicteindia.org/dbook.php>*)
- ✓ **Text Book of Chemistry for Class XI & XII (Part-I, Part-II)**; N.C.E.R.T., Delhi, 2017-18.
- ✓ **Dr. G. H. Hugar and Prof A. N. Pathak**, *Applied Chemistry Laboratory Practices*, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.

- ✓ **Agnihotri, Rajesh**, *Chemistry for Engineers*, Wiley India Pvt. Ltd., 2014.
- ✓ **Jain & Jain**, *Engineering Chemistry*, Dhanpat Rai and Sons; New Delhi, 2015.

Signature of Faculty

Principal