INSTITUTE	**FACULTY OF SCIENCE**
PROGRAM	**BACHELOR OF SCIENCE (CHEMISTRY)**
SEMESTER	**5**
COURSE TITLE	**ANALYTICAL CHEMISTRY**
COURSE CODE	**02CY0304**
COURSE CREDITS	**6**

Course Outcomes: After completion of this course, student will be able to:

1 Understand the concepts errors and statics.
2 Be aware of the basics of environmental chemistry and its effect on nature.
3 Obtain the information regarding titration and methods of analysis.
4 Understand the basic of chromatography method.

Pre-requisite of course: Understand Fundamentals of analytical chemistry.

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
5	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	**Errors and statistics** Introduction, Types of errors, Method for minimization of errors, Absolute error, Relative error, Mean value, Deviation, Mean deviation, Relative mean deviation, Standard deviation, Co-efficient of variance, Spread or range, Confidence interval and limit, Accuracy, Precision, Difference between accuracy and precision, Significant figures, Law of significant figure, Law of addition and subtraction, Law of units of importance, Law of multiplication and division, Gausian curve, Q-Test, F-Test, Numericals.	15

Contents : Unit	Topics	Contact Hours
2	**Selected topics on Environmental Chemistry** Concept and scope of environmental chemistry, Atmosphere, Composition of atmosphere, Atmosphere structure, Evolution of atmosphere, Earth's radiation balance, Particles, Ions and radicals in the atmosphere, Chemical and photochemical reactions in the atmosphere, Oxygen and ozone chemistry, Greenhouse effect, Ozone hole, Chemical toxicology, Biological effect of arsenic, Biological effect of cadmium, Biological effects of pesticides, Biological effects of DDT, Hydrocarbon and photochemical smog, Acid rain, Particulates, Effect of atmospheric pollution, Sampling, Waste water treatment, Trace elements in water, Dissolved oxygen, Chemical oxygen demand, Biochemical oxygen demand.	15
3	**Types of titration and Classical methods of Analysis** Introduction, Acid-base titration or acidimetry and alkalimetry, Oxidation-reduction titration or redox titration, Precipitation titration, Complexometric titration, Gravimetric method of analysis and its applications, Properties of precipitates and precipitating reagents, Colloidal precipitates, Crystalline precipitates, Coprecipitation, Precipitation from homogeneous solution, Drying and Ignition of precipitates, Equivalence points and end points, Primary standards, Secondary standards, Solutions and indicators for acid base titrations, Acid base indicators, Choosing an indicator-The feasibility of titration.	15
4	**Basics of Chromatography** Introduction, Classical and modern separation techniques, Comparison between classical and modern chromatography, Classification and types of chromatography, Adsorption, Partition, Basic theory and applications involved with Liquid chromatography, Gas chromatography, Paper chromatography, Thin layer chromatography, Column chromatography and ion exchange chromatography	15
Total Hours		**60**

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	**Experiments** Experiment-1, Experiment-2, Experiment-3, Experiment-4, Experiment-5, Experiment-6, Experiment-7, Experiment-8	
Total Hours		

References:

1 An Introduction to Chemical Thermodynamics; R. P. Rastogi, R. R. Misra, 6thEdition, Vikas Pub. Pvt. Ltd.

References:

2 Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma, K. C. Kalia,Vallabh Publications, Delhi

3 Basic statistics, Basic statistics, B L Agarwal, New age International, 2006

4 A Textbook of Environmental Chemistry and Pollution Control, A Textbook of Environmental Chemistry and Pollution Control, SS Dara and DD Mishra, S. Chand Publishing, 2006

5 Titration Theory, Types, Techniques and Uses, Titration Theory, Types, Techniques and Uses, Tanvi Lavanya Joshi, Nova Science Publishers, 2018

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation

Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking
10.00	20.00	25.00	25.00	10.00	10.00

Instructional Method:

1 The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

3 Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

5 Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.

6 All students in the laboratory must wear safety goggles and lab coats during lab session.

Supplementary Resources:

1 http://nptel.ac.in/course.php?disciplineId=104

2 http://ocw.mit.edu/courses/chemistry/

3 http://vlab.amrita.edu/index.php?sub=2

4 http://www.vlab.co.in/ba_labs_all.php?id=9

5 https://www.youtube.com/user/TMPChem

6 https://www.youtube.com/playlist?list=PL166048DD75B05C0D

7 https://www.youtube.com/channel/UCqk-dmk3AOFtikaFDpsZorg

8 https://www.youtube.com/user/PradeepKshetrapal