

**Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon
Ordinance 181**

College Name: Khandesh College Education Society's Post Graduate College of Science,
Technology & Research, Jalgaon

Title of the Course: Certificate Course in Bio-analytical Techniques and Bioinformatics

Aims/Objective of the Course:

- The primary objectives of this course are to develop the skills to understand the theory and practice of bio-analytical techniques.
- To provide scientific understanding of analytical techniques and detail interpretation of results.
- Familiarity with working principles, tools and techniques of analytical techniques.
- A comprehensive knowledge of the equipment used in Life sciences
- To give students an introduction to the basic practical techniques of bioinformatics.
- Emphasis will be given to the application of bioinformatics and biological databases to problem solving in real research problems
- A student completing a course in Bioinformatics shall be able to apply: knowledge and awareness of the basic principles and concepts of biology, computer science and mathematics.

Duration of Course : 1 Year

Fee Structure : Rs. 2000/-

Course Structure:

1) Paper- I	: Introduction to Bio-analytical tools
2) Paper- II	: Bio-analytical tools and Techniques
3) Practical Course	: Practicals in Bio-analytical Techniques

Eligibility for admission : B. Sc. In Life Sciences

Skeleton Course:

Sr. No.	Paper	Name of the Subject	Theory/ Practical	Teaching Hours	Maximum marks allotted			Passing			Credit
					External	Internal	Total	External	Internal	Total	
1	Paper - I	Introduction to bio-analytical tools	Theory	90	60	40	100	24	16	40	6
2	Paper - II	Bio-analytical tools and Techniques	Theory	90	60	40	100	24	16	40	6
3	Paper - III	Practicals in Bio-analytical techniques	Practical	120	60	40	100	24	16	40	8

- **Internal Marks are divided in 3 parts e.g. 05 marks for Attendance, 10 marks for home Assignment Tutorial & 25 marks for Internal Test.**

Minimum Staff : 3
 Mode of Examination : Annual
 Detail syllabus : Attached herewith

Syllabus

Certificate Course in Bio-analytical Techniques and Bioinformatics

Paper I: Introduction to Bio-analytical tools **6 credits**

Unit 1: Introduction **10 hrs**

Modern approaches in Bio-analysis and Bioassays.

Unit 2: Concepts of Acid, base, buffers, pH , pOH , pKa. Preparation of stock solutions **20 hrs**

Unit 3 : Spectroscopic techniques **20 hrs**
 Principle, Design and Applications, UV-Visible Spectroscopy, Fluorescence Spectroscopy, IR spectroscopy and CD spectroscopy.

Unit 4 : Microscopic Techniques I **20 hrs**
 Principle, Design and Applications, Light Microscopy; Fluorescence Microscopy and Atomic force Microscope.

Unit 5: Microscopic Techniques II **20 hrs**
 Principle, Design And Applications, Scanning electron microscopy, Transmission Electron microscope. Application of microscope in analyzing biological samples.

Paper II: Bio-analytical tools and Techniques **6 Credits**

Unit 1: Electrophoretic Techniques **10 hrs**
 Electrophoresis, Principle, Design of horizontal and vertical gel electrophoresis apparatus, performing electrophoresis techniques, application of electrophoresis in analyzing macromolecules.

Unit 2: Chromatographic Techniques **20 hrs**
 Chromatographic techniques; Principles, Column chromatography, HPLC, TLC, Paper chromatography.

Unit 3: Bioinformatics Tools **20 hrs**
 Computational approaches in analyzing protein and nucleic acid sequences, Analysis of protein structures.

1. Rasmol
2. BLAST
3. Expasy
4. Primer Designing

Unit 4 : Computer aided drug design and screening. **20 hrs**
 Structure based drug design, Ligand based drug design, Methods and Materials

Unit 5. Isotopes in Biology**20 hrs**

Radioactive decay, production of isotopes, measurement of radioactivity

Paper III :Practicals in Bioanalytical Techniques**120 hrs**

1. Preparation stock and solutions
2. Determination of pKa value by titration
3. Separations of bio-molecules by column chromatography
4. Verification of Beers and Lamberts law
5. Separation of DNA by agarose gel electrophoresis
6. Separation of Protein by SDS PAGE
7. Separation of amino acid by TLC
8. Separation of sugar by paper chromatography
9. Demonstration of HPLC
10. Protein structure analysis by ExPasy server
11. Pairwise sequence analysis by BLAST
12. Phylogenetic analysis
13. Protein structure design by Rasmol
14. Qualitative determination of protein by UV- spectrometry

References

1. D. Baxevanis, B. F. F. Ouellette, Bioinformatics-A practical Guide to the analysis of Genes and Proteins, 2nd Ed, John Wiley and Sons Inc., 2001.
2. Basic Methods in Microscopy, Protocols and concepts from cells: A Laboratory Manual, D. L. Spector & R. D. Goldman (Editors.), Cold Spring Harbor Laboratory Press, 2006
3. T. Lengauer; Bioinformatics - From Genomes to Drugs, Vols 1 & 2, Wiley-VCH, 2002.
4. Live Cell Imaging: A Laboratory Manual R. D. Goldman, J. R. Swedlow and D. L. Spector Cold Spring Harbor Laboratory Press; 2nd edition, 2009
5. Upadhyay, Upadhyay and Nath, (2000) Biophysical Chemistry Himalaya Publisher, Nagpur.
6. Friefelder D. (1993) Physical Biochemistry 2nd Edn. W. H. Freeman & Co., USA.
7. Van Holde, K. E. (1985) Physical Biochemistry, 2nd Edn. Prentice Hall Inc. New Jersey.
8. Skoog DA, Hollier FJ, Nieman IA (1998) Principles of Instrumental Analysis Harcourt Brace College Publishers
9. K. Wilson and J. Walker (2000) Practical Biochemistry: Principles and techniques (5th Edition) by. Cambridge University Press, Cambridge,
10. Willard HH, Merrit Jr LL. (1986) Instrumental Methods of Chemical Analysis, CBS Publishers,
11. Wilson K and Goulding KH, Biologists Guide to Principle and Techniques of
12. Practical Biochemistry ELBS Publications.
13. Mikkelsen SR, Corton E. (2004) Bioanalytical Chemistry, Wiley Interscience, NY, USA,

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College Name : Khandesh College Education Society's Post Graduate
 College of Science, Technology & Research, Jalgaon

Title of the Course: **Certificate Course in Analytical Chemistry**

Aims/Objective of the Course:

- To develop transferable and life skills in students.
- To introduce a wide range of techniques useful in modern analytical chemistry.
- To provide background of Analytical chemistry principles those are practically important.

Duration of Course : 1 Year

Fee Structure : Rs. 2000/-

Course Structure :

- 1) Paper- I : Fundamentals of Analytical Chemistry 6 Credits
- 2) Paper- II : Instrumental methods of analysis 6 Credits
- 3) Practical Course: Practical Course in Analytical Chemistry 8 Credits

Eligibility for admission : **B. Sc. Chemistry**

Skeleton Course:

Sr . No.	Paper	Name of the Subject	Theory/ Practical	Teachi ng Hours	Maximum marks allotted			Passing			Cre dit
					External	Internal	Total	External	Internal	Total	
1	Paper - I	Fundamentals of Analytical Chemistry	Theory	90	60	40	100	24	16	40	6
2	Paper - II	Instrumental methods of analysis	Theory	90	60	40	100	24	16	40	6
3	Paper - III	Practical Course in Analytical Chemistry	Practical	120	60	40	100	24	16	40	8

- **Internal Marks are divided in 3 parts e.g. 05 marks for Attendance, 10 marks for home Assignment Tutorial & 25 marks for Internal Test.**

Minimum Staff : 3

Mode of Examination : Annual

Detail syllabus : Attached herewith

Syllabus

PAPER-I FUNDAMENTALS OF ANALYTICAL CHEMISTRY 6 Credits

UNIT-I :Basic Tools and Operations of Analytical Chemistry 20 hrs

Laboratory Notebook, Laboratory Material and Reagents, The Analytical Balance, Volumetric Glassware, Preparation of Standard Base Solution, Preparation of Standard Acid Solution, Other Apparatus- Handling and Treating Samples, Igniting Precipitates Gravimetric Analysis, Laboratory safety.

UNIT-II :Data Handling and Spreadsheets in Analytical Chemistry 20 hrs

Accuracy and Precision, Determinate Errors, Indeterminate Errors, Minimization of Errors, Significant Figures, Rounding off, Ways of Expressing Accuracy, Standard Deviation, Use of Spreadsheets in Analytical Chemistry, The Confidence limit , Rejection of a Result The Q Test.

UNIT-III: Good Laboratory Practice: Quality Assurance of Analytical Measurement 10hrs

Good Laboratory Practice, Validation of Analytical Methods, Quality Assurance, Laboratory Accreditation, Electronic Record and Electronic Signature: 21 CFR, Part 11, Official Organization.

UNIT-IV : Acid-Base Equilibria 20 hrs

Acid-Base Theories, Acid-Base Equilibria in Water, The P^H Scale, P^H at Elevated Temperature: Blood P^H , Weak Acid and Bases, Salts of Weak Acid and Bases, Buffers-Keeping the P^H Constant, Polyprotic Acid and Their Salts,

UNIT-V : Clinical Chemistry and Forensic Chemistry 10 hrs

Composition of Blood, Collection and Preservation of Samples, Clinical Analysis-Common Determination, Immunoassay.

UNIT-VI : Environmental Sampling and Analysis 10 hrs

Getting a meaningful Sample, Air Sample Collection and Analysis, Water Sample Collection and Analysis, Soil and Sediment Sampling, Sample Preparation for Trace Organics, Contaminated Land Sites, EPA Methods and Performance-based analysis.

References:

- 1) Analytical Chemistry, Sixth Edition by G.D. Christian, John Wiley Sons.
- 2) Instrumental methods of Chemical Analysis, by Chatwal and Anand, Himalaya Publishing House.

3) Text Book of Quantitative Inorganic Analysis, Theory and Practice, by A.I.Vogel

PAPER-II INSTRUMENTATION AND CHEMICAL ANALYSIS **6 Credits**

UNIT I: Conductometry **12 hrs**

Introduction, Some important Laws, Definitions and Relations, Conductance Measurement, Applications of Conductance Measurements, Types of Conductometric Titrations, Advantages and Disadvantage of Conductometric Titration.

Unit II: Potentiometry **12 hrs**

Introduction, instrumentation, Types of Potentiometric Titrations and Advantages of Potentiometric Titrations.

Unit III: P^H metry **12 hrs**

Introduction, Determination of P^H, Instrumentation & Applications of P^H Measurement.

UNIT IV:Polarimetry **12 hrs**

Introduction, Plane polarized Light, Optical Activity, and Types of Molecules Analyzed by Polarimetry. Theory of Optical Activity, Polarimetry and Applications of Optical Activity.

UNIT V:Refractometry **12 hrs**

Introduction, Abbe Refractometer, Applications of Refractometry, Optical Exaltation.

UNIT VI : Chemical Analysis of soil **15 hrs**

Introduction to Soil, Sample Collection, Preparation of Extract, Analysis of Some Typical.

UNIT VII: Chemical Analysis of water **15 hrs**

Water Quality Parameters and Standards, Sampling, Preservation, Water Pollution, Types and Sources of Water Pollution, Analysis of Organic and Inorganic Pollutants.

References

1. Basic Concepts of Analytical Chemistry, S. M. Khopkar, Wiley Eastern Limited.
2. Vogel's Text Book of Quantity Chemical Analysis, Sixth Edition, ELBS.
3. Analytical Chemistry, Sixth Edition by G.D. Christian, John Wiley Sons.
4. Environmental Chemistry. By A.K. De, New Age International Publishers.
5. Instrumental Methods of Chemical Analysis, Sixth edition, by Willard, Dean, Merritt, Settle, CBS Pub. Delhi.
6. Instrumental Methods of Chemicals Analysis, by H. Kaur, Pragati Prakashan.

7. Fundamental of Analysis Chemistry, Eighth edition by Skoog. West, Holler and Crouch. Published by Thomson, Brooks/Cole.
8. Instrumental methods of Chemical Analysis, by Chatwal and Anand, Himalaya Publishing House.
9. Methods of Analysis of Soils, Plants, Waters and Fertilisers, by HLS tendon, Fertiliser Development and Consultation Organisation.

PRACTICAL COURSE IN ANYALYTICAL CHEMISTRY

8 Credits

Perform any 15 Practicals.

1. Analysis of Food Adulteration in Food Sample Chili, Turmeric Powder, Milk, Honey, Oil, Ghee.
2. Determination of Chloride Contents in A Given Water Sample by Mohr's Method.
3. Estimation of Calcium from the Drug Sample.
4. Estimation of Phosphorus from the Fertilizer.
5. Determination of p^H of the Soil Sample Using Universal Indicator.
6. Determination of R_f Values of the Components of Binary Mixture by TLC.
7. Analysis of aspirin by Conductmetric Titration.
8. Determination of P^H , of Hair Shampoos/ Tooth Pastes.
9. Determination of the Amount of Cu^{2+} By Titration with EDTA Spectro Photometrically Using Liquor Ammonia.
10. Determination of PK_a Value of Given Organic Acid by P^H Metric Titration.
11. Conductmetric Titration of Strong Acid, Weak Acid and Salt with NaOH.
12. Determination of Nitrate in the Given Water Sample Spectrophotometrically.
13. Determination of Hardness of the Given Water Sample Titrimetrically.
14. Determination of Calcium in Cement Sample Titrimetrically.
15. Determination of Physical Parameters of Waste Water P^H , Colour, Conductivity.
16. Determination of Refractive index of Given Edible Oil/Solvents and Determine its Percentage Purity.
17. Preparation and Standardization of any 2 Solutions-
0.1N $KMnO_4$, 0.1M $KMnO_4$, 0.1N Oxalic acid, 0.1N H_2SO_4 .
18. Analysis of Iodized Table Salt.
19. Determination of SAP Value of oil.

References-

- 1) Text Book of Quantitative Inorganic Analysis, Third Edition, by A.I.Vogel.
- 2) Systematic practical Chemistry by P.C. Komboj.
- 3) Methods in environmental analysis- Water, Soil and air by P.K. Gupta.
- 4) Handbooks of methods in environmental studies. Vo. 1: Water and waste water analysis by S. K. Maiti

Certificate course in Statistical Methods of Analysis

Eligibility: B. Sc.

Duration: 6 months

Syllabus

Theory paper- I100 marks (40+60)

Unit I: Introduction Basics of statistics

Concept of population, sample and random sampling, intuition behind laws of large numbers and advantage of sufficiently large sample. Graphical techniques, Measures of location and dispersion, sampling distribution, and standard deviation of sample.

Unit II: Collection, classification and tabulation of data

Mean, median, mode, Coefficient of variation, Confidence interval. Standard error, variance, standard deviation, Probability theorem; random experiments, sample space, probability theory, conditional probability, Histograms : Construction and Interpretation

Theory paper-II100 marks (40+60)

Unit I: Correlation and Regression Analysis

Relation between two variables, scatter diagram, definition of correlation, curve fitting, principles of least squares, two regression lines, Karl Pearson's coefficient of correlation

Unit II: Analysis of variance

One and two way analysis of variance, Introduction to designs of experiments,

Practical paper: based on Paper I and II