

INCLUSION OF RESEARCH ETHICS IN THE RESEARCH METHODOLOGY COURSE WORK

Research programmes offered by all the research departments of Nallamuthu Gounder Mahalingam College that adhere to the Bharathiar University syllabus. When it comes to carrying out the measures announced by the University Grants Commission, New Delhi, it has always served as a model for other universities. A number of departments have included curriculum papers on research ethics and methodology in their curricula of study. The significance of conducting a plagiarism check has been reinforced and thoroughly educated at the Department of Biotechnology as well as Postgraduate department of Chemistry. Topics on paper publication, proposal writing, thesis writing, research paper writing, precautions in writing research papers, and bibliography citations have been well-emphasized at the PG level in the curricula of the Departments of Chemistry, Commerce, Computer Science and Botany. The writing of research proposal for project and research reports is a skill that is well taught in the departments of economics, educational technology, Departments of Chemistry, Commerce, and education through curriculum-framed instruction.

Papers on research ethics, intellectual property rights, thesis writing ethics, and other topics have been added to the curriculum in science departments such as Environmental Sciences, Microbiology, Statistics, and Zoology in accordance with ethical research pedagogy. The Arignar Anna Central Library at Bharathiar University has an active subscription to the plagiarism detection program Turnitin, which is heavily used by research scientists, faculty, and students in an effort to promote ethical research methods within the institution. For articles written by faculty and research scholars of NGMC check the level of plagiarism using X Plagiarism software available in the institution. The research pedagogy has also been well framed and functionalized at the University through providing awareness programmes and brainstorming sessions conducted as and when required by the students and this is in view of inculcating the habit of coming up with proper and authentic research curriculum and practices at the University.



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Programme Code:	M.Sc			Programme Title:	Master of Chemistry		
Course Code:	22PCY2E1			Major Elective –I: Green Chemistry, Research methodology and Cyber Security	Batch:	2022 - 2024	
					Semester:	II	
Lecture Hrs./Week	3	Tutorial	-	Total Hrs/Sem	45	Credits:	3
Course Objective							
* To stimulate students to have in-depth knowledge in green chemistry.							
* To acquire a clear idea about various synthesis of Nanomaterials and techniques.							
* To gain knowledge about the significance of research and scientific writing.							
* To apply the principles of Cyber Security and its attack.							

Course Outcomes

On the completion of the course the student will be able to

#	CO Statement	Knowledge Level
CO1	Understand the principles and tools of green chemistry.	K2, K3
CO2	Recollect the hazardous effect of chemicals and solvents used in laboratory.	K3
CO3	Ability to write a good research report.	K5
CO4	Get the idea about cyber security.	K3
CO5	Apply the ideas of legal and ethical issues for cybercrime and plagiarism.	K4
K1 - Remember; K2 - Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate		

Units	Content	Hrs
Unit I	Green Chemistry Principles Definition, need of green chemistry, twelve basic principles of green chemistry- planning a green synthesis in a chemical laboratory- solvent-less reactions, selection of appropriate solvent, use of microwaves-fundamentals of closed-vessel heating and sonication. Atom efficient processes and atom efficiency, atom economy (with specific reaction).	9
Unit II	Greener Reactions Water as greener solvent- reactions in ionic-liquid, solvent free reaction- solid supported organic synthesis, phase transfer catalyst (PTC), use of microwaves and sonication (any four specific reactions with mechanism).	9

Unit III	Research Methodology Concepts of Research - Importance of research in science, Criteria of good research, Sources of a research problem. Types of research - Basic, applied, action, experimental, diagnostic and exploratory. Primary and secondary sources-N-list-journals, plagiarism, Intellectual property rights, patent, trade mark, Copyrights, Plagiarism. Web of science, Scopus, citations-Science citation index- H – Index, I-10 Index. Scientific Writing Nature and purpose, the components of dissertation and Research paper, Writing techniques. Types of scientific publications-magazines, journals, reviews, news, letters, Structure of Scientific paper. Various reference styles.	13
Unit IV	Over view of cyber security Confidentiality, integrity and availability Threats: Malicious software (viruses, Trojans, root kits, worms, and botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string). Cryptography- Authentication, password system- windows security.	7
Unit V	Network security: Network intrusion detection and prevention system, firewalls. Software security: Vulnerability auditing, penetration testing, sandboxing, control flow integrity – web security: user authentication- Legal and ethical issues: trade secret, hacking and intrusion, privacy, identity theft- Legal and ethical issues and Cybercrime.	7
	Total Contact Hrs	45

Pedagogy

Direct Instruction, Flipped Class, Digital Presentation

Assessment Methods:

Seminar, Quiz, Assignments, Group Task.

Text Book

22PCY2E1

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ahluwalia. V.K,	Green Chemistry (Environmental benign Reactions)	Ane Books Pvt. Ltd	2006
2	Asim K. Das	Environmental Chemistry with Green Chemistry	Arunabha sen books and allied Pvt. Limited.	2012
3	Kothari. C.R	Research Methodology	New Age International (P) Limited.	2011

22UCC6AL

Programme Code:	BCCA			Programme Title	Bachelor of Commerce with Computer Applications	
Course Code:	22UCC6AL			Course Title	Batch :	2022-2025
Lecture Hrs./ Week Or Practical Hrs./Week	SS	Tutorial Hrs./Sem	-	Advanced Learner Course II – Basics of Research Techniques	Semester:	VI
					Credits:	2**

Course Objective:

To understand some basic concepts of research and its methodologies

Course Outcomes (CO)

On the successful completion of the course, students will be able to

CO	Course Statement	Knowledge Level
CO1	Understand the basic concepts of research.	K1
CO2	Identify the research problems and to formulate research design	K2
CO3	Implement suitable method for data collection and frame questionnaire.	K3
CO4	Apply statistical tools for analysis	K4
CO5	Infer and interpret the data and prepare the research report	K5

Mapping

PO / PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
CO1	M	H	M	M	L	H	H	L	H	H	H	L
CO2	M	H	H	H	M	M	M	H	H	H	H	M
CO3	M	H	L	H	H	L	H	L	H	H	M	H
CO4	H	H	H	M	H	M	H	M	H	H	M	H
CO5	H	H	M	H	M	H	L	H	H	H	M	M

Unit	Content	Hours
Unit- 1	Research: Meaning – Objectives – Significance and types – Research process – Criteria of good research – Formulation of research problem – Selecting the research problem – Techniques involved in defining a research problem.	
Unit- 2	Research Design-Meaning-Need for Research design- Features of a good design - Important concepts of research design - Types of Research Design - Hypotheses-Types of hypotheses – Framing of hypotheses.	

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PAPER – I: RESEARCH METHODOLOGY

UNIT - I

Dissertation: Nature and purpose, components and preparation- Writing techniques: Introduction, word processing and page layout, writing and formatting with a computer- Figures: general considerations, line art, drawing with a computer and halftones- Tables: logic behind a table, significance of a table, form of a table, components of a table - Worksheets, lists and databases. Plagiarism.

Collection and Citation of Literature:

Acquisition of information, building up of own literature collection, citation techniques, forms of citation, web of science, SCI, Scopus, H index and I10 index.

Publication of Journal Articles:

Concept, electronic publication, types of journals, impact factor, decision prior to publication, components of a journal article, preparation of the manuscript, from manuscript to publication and online submission.

Submission of Research Proposals:

Leading funding agencies in India, Submission of research project proposals with prescribed formats.

UNIT - II Data

Analysis:

Errors – classification of errors - precision - accuracy – improving accuracy of analysis – significant figures – mean, standard deviation – comparison of results: “t” test, “F” test and “chi” square test – rejection of results – presentation of data.

Sampling – introduction – definitions – theory of sampling – techniques of sampling – statistical criteria of good sampling and required size – stratified sampling vs random sampling – minimization of variance in stratified sampling – transmission and storage of samples.

UNIT - III

Atomic Spectroscopy and Flame emission

Spectroscopy

Types of atomic spectroscopy – emission methods – absorption methods – fluorescence methods – atomizers for atomic spectroscopy: flame atomizers, Electrothermal atomizers – inductively coupled plasma sources of radiation – Instrumentation - Applications of atomic emission spectroscopy – flames and flame spectra.

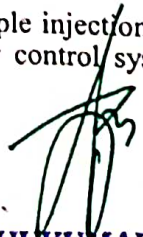
Fluorometric analysis:

Types of Fluorescence and phosphorescence – factors affecting fluorescence and Phosphorescence – quenching – relation between intensity of fluorescence and concentration – measurement of fluorescence – applications.

UNIT - IV

Gas Chromatography:

Theory of chromatography – column efficiency and column equation – sample injection – sampling system for capillary columns and packed columns – detectors – gas flow control system – high resolution gas chromatography/mass spectrometry.


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Unit- 3	Collection of Data: Primary – Secondary – Methods – Questionnaire – Types – Pre test – Pilot study – Testing and Validating Questionnaire.	
Unit- 4	Data Editing-data validation – Tabulation - Types of Tables. Data processing, analysis and presentation - Testing of hypotheses - Use of Statistical Packages - Entering data using Spreadsheet – Functions and Formulac.	
Unit- 5	Interpretation and Report Writing: Meaning of Interpretation – Why interpretation – Techniques of interpretation – Report writing – Mechanics of writing a Research report.	

Pedagogy and Assessment Methods:

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Experience Discussion and Case study

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Kothari, C.R, and Gaurav Gar	Research Methodology Methods and Techniques	New Age International, New Delhi.	2019

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Devendra Thakur,	Research Methodology in Social Sciences,	Deep and Deep, New Delhi.	2017
2	Gopal Lal Jain	Mangal Deep, Jaipur.	Mangal Deep, Jaipur.	2014
3	Bhome Sharadha	Research Methodology	Himalaya publication house Pvt. Ltd, New Delhi	2018

Course Designed by	Head of the Department	Curriculum Development Cell	Controller of the Examination
Name and Signature	Name and Signature	Name and Signature	Name and Signature
Dr.P.Gomathi Devi	Dr.P.Archanaa	Prof.K.Srinivasan	Dr.R.ManickaChethan
Signature:	Signature:	Signature:	Signature:

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PAPER I: RESEARCH METHODOLOGY

UNIT-I

Economic Research: Significance of Economic Research – Types of Research – Formation of Research Problem – Formulation of Hypothesis – Sources of Data – Methods of Data Collection – Sampling design: Random and Non-random.

UNIT-II

Data analysis: Measuring of central Tendency and Dispersion – Tests of Hypothesis – Types of Errors – Parametric and Non-Parametric test: „t“ Test – „z“ Test – „F“ Test and ANOVA – Chi-square Test

UNIT-III

Correlation: Meaning – Types of Correlation: Simple, Partial and Multiple Correlation – Regression: Meaning – Linear Regression – Difference between Correlation and Regression.

UNIT-IV

Index Numbers: Their concept as Weighted Averages – Problems in the Construction of Index Numbers – Chain Index – Cost of Living Index Number (different formulae) – Wholesale Price Index and Cost of Living Index in India – Uses of Index Numbers.

Time Series Analysis: Meaning – Components of Time series – Measurement of Trend: Method of Least Square – Measurement of Seasonal Variation: Ratio – to Moving Average Method.

UNIT-V -Research paper writing – content-structure-types – ranking

Thesis and Report Writing – Different stages in writing Report – Layout of the Research Report – Types – Precautions in writing Research Reports – Foot notes – Bibliography.

(Note: Question Pattern: Theoretical aspects 70% and Problem 30%. In either or question pattern, questions 2(b), 3(b) and 4(b) may be problem solving)

References

1. C.R.Kothari – Research Methodology, methods and Techniques – Willy Eastern Ltd., 1988.
2. A.Koutsoyiannis – Theory of Econometrics – An Introductory Exposition of Econometrics Methods - Macmillan Ltd., 1987.
3. M.Cohen and E.Nagal – An Introduction to logic and Scientific method, New York 1962
4. William J Goode & Paul K Hatt – Methods in Social Research, 1972
5. Pauling V.Young – Scientific Social Survey's and Research, Prentice Hall – (Dorsey Press), New York.
6. Wonnacott and Wonnacott – Econometrics


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M.PHIL. / PH.D. –EDUCATIONAL TECHNOLOGY

PART – I SYLLABUS

(For the candidates admitted from the academic year 2018-19 onwards)

PAPER I: RESEARCH METHODS AND ADVANCED STATISTICS

OBJECTIVES

1. To enable students to understand advance research methods and statistical tools in education
2. To enable students to understand the principles of evaluation, research and statistics
3. To help students in preparing model research proposals for research studies

UNIT I: RESEARCH METHODS

Research – Nature, types and scope – Research Trends in Education – Qualitative Research Techniques – Historical case study, Participatory and Ethnography Research Methods – Quantitative Research Techniques – Survey, Experimental, Action, Longitudinal Research Methods – Tools for data collection: Observation, Interview schedule, Checklist Questionnaire, Achievement test and attitude scale – Design, Construction and Standardization of tools – Research Design.

UNIT II: SAMPLING TECHNIQUES AND MEASUREMENT

Sampling Method – Purposive sampling, simple random sampling, systematic sampling, stratified sampling, cluster sampling, stage sampling – Theories of Probability – levels of confidence – Degrees of freedom – Hypothesis formulation and testing statistical significance, one tailed and two tailed tests – correlated and uncorrelated data – Scales of Measurement – Nominal scale, Ordinal scale, Interval scale and Ratio scale.

UNIT III: INTRODUCTION TO STATISTICS

Introduction to statistics – meaning, scope, importance and limitations of statistics – concept of statistics, source of data, populations, parameters, samples and statistics – descriptive and inferential statistics, parametric and non-parametric statistics, variables – discrete and continuous variables, independent and dependent, intervening and manipulating variables – classifying and presenting the data, frequency table, presentation of data, Bar graphs, Histogram, Frequency polygon, smoothed frequency polygon, Cumulative frequency graph (or) Ogive and pie graph

UNIT IV: ADVANCED STATISTICAL TECHNIQUE

Univariate Analysis: mean, median, mode – measures of central tendency, normal curve, practical application of normal probability curve, characteristics of normal probability curve – range– variance – percentile, standard scores (or) 'Z' scores – Type I and Type II error, sampling error, statistical significance–Bivariate analysis: Correlation methods – Chi-square, T-test, ANOVA and MANOVA

UNIT V: COMPUTER APPLICATION AND REPORT PREPARATION

Computer Application: Statistical Package for Social Sciences (SPSS), Computer packages: word processing and graphs – Preparation of Research Documents: Preparation of Research


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proposals, writing of the report of the research studies, preparation of review of related studies, preparation of the review of research proposals and reports.

References

1. Kerlinger H Fred. (1964) Foundations of Behavioural Research: Educational Psychological Inquiry.
2. Goode & Hatt. (1952) Methods in Social Research
3. Paulin Young. (1961) Scientific Social Survey and Research
4. John Best. (1975) Fundamentals of Social Research
5. Edwards A L (1966) Experimental Design in Psychological and Education
6. Covers, P.S. (1980) Computer Programming In Basic, Madras Allied Publisher (p) Ltd.

PAPER II: ADVANCED EDUCATIONAL TECHNOLOGY

OBJECTIVES

1. To study how audio, video, and computer technologies can best be exploited in teaching and learning
2. To study the principals involved in the production of media related materials

UNIT I: MODERN COMMUNICATION TECHNOLOGY IN EDUCATION- MEANING, SCOPE AND CHOICE

Systems approach to instruction and instructional designs

Audio visual technology: projected and non-projected aids

Individualized instruction: Keller Plan, PSI, CAI, CMI & PLM

Advanced Techniques In Education: Multimedia, interactive video, teleconferencing, tele-bridge, teletext and videotex

UNIT II: TECHNOLOGY IN LANGUAGE TEACHING

Principles of Language teaching

Approaches to Language teaching

Different methods of teaching English as a second language

Audio-video media in English language teaching

Meaning and Need for Language Laboratory

UNIT III: EDUCATIONAL TECHNOLOGY FOR FORMAL, INFORMAL AND NONFORMAL SYSTEMS IN LEARNING: CONCEPT AND SCOPE

Role, experience and applications of Educational Technology in school education and higher education

Role, experience and applications of Educational Technology in Special groups:

Special education and distance education

Interpersonal approach: IEC, Social Marketing Approach, Participatory

Communication approach

Media approach: development communication approach, development support communication approach and media forum



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Paper – I: RESEARCH METHODOLOGY

Unit-I Introduction to Research Methodology

What is Research? Basic and applied research, Essential steps in research, Defining the research problem, Research/ Experimental design, Literature collection, Literature collection, Literature citation, Research report: components, Format of thesis and dissertation, Manuscript /Research article, Review monographs, Bibliography and Reference, Significance of research-Software for manuscript draft.

Unit-II Bio-statistical Methods

Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance; X^2 test; basic introduction to Multivariate statistics, etc.,

Unit-III Applied Bio-statistics

R Language and its simple applications – Computation of Probabilities and cumulative Probabilities using Binomial and Poisson models. Evaluation area and ordinate under normal distribution using R Software, SPSS.

Unit-IV Research Ethics & IPR

Perspective of Ethics, Personal vs professional ethics: Moral Reasoning – Ethical theories, Deontological, Utilitarianism – Ethical leadership (integrity and ingenuity) - framework for ethical decision making- Michael Macdonald model & Storch model, Plagiarism software

Introduction to intellectual property and intellectual property rights Types, patents, copy rights, trade marks, design rights, geographical indications – importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO)

Unit-V Biosafety guidelines

Introduction to biosafety Biosafety issues in biotechnology – risk assessment and risk management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containment; Depository regulation- National & International centers; Biological databases.

References:

- C.R. Kothari, IInd edition (2004) Research methodology, Methods and techniques, New Age International (P) Ltd, Publishers, New Delhi.
- Jenod H. Zar (1999) Biostatistical analysis by, Prentice Hall International, Inc. Press, London.


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PAPER I: RESEARCH METHODOLOGY

UNIT I: BIOINSTRUMENTATION

Principle & Applications of pH meter – Ultracentrifuge – UV visible spectrophotometer, FTIR, Atomic absorption spectrophotometer – XRD- NMR – MALDI TOF -Electron microscope (SEM & TEM) – FRET Microscopy.

UNIT II: ANALYTICAL TECHNIQUES

Principles and Procedure of Chromatography: Thin layer chromatography - High performance liquid chromatography, Gas Chromatography, Electrophoresis: Agarose & PAGE. Blotting techniques: Southern, Northern & Western, PCR – ELISA.

UNIT III: HISTOLOGICAL TECHNIQUES

Processing tissue samples for light and electron microscopy, Immunochemical localization- Cryostat Sectioning - Flow cytometry - FISH and GISH - Microarray.

UNIT IV: DATA PROCESSING AND ANALYSIS

Biostatistics: Correlation Co-efficient; Simple linear regression, Student's 't' test; Chi -square test, 'F' test; ANOVA – one way; two way – Multiple/Post Hoc comparison in ANOVA

Bioinformatics: Generalized and specialized data bases with examples –BLAST - Multiple Sequence Alignments. Molecular Divergence & Phylogenetic trees.

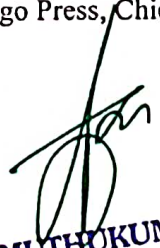
UNIT V: RESEARCH METHODS AND THESIS WRITING

Identification of research problems – Methods of literature collection and review – Planning and execution of investigation – Thesis writing – Preparation of research papers- Ethics in thesis writing.

REFERENCES*

1. Anderson, Durston & Polle 1970: Thesis and assignment, writing Wiley Eastern Limited.
2. Bier, 1959: Electrophoresis, theory, methods and applications, Academic Press, London, New York.
3. Block, R. I. Durram E.K. and Eweig, G, 1956: A manual of paper chromatography and electrophoresis, Academic press, New York.
4. Chayan J & Butcher R.G, 1973: Practical histochemistry, Willey Interscience Publication, London.
5. Clark G.L, 1961: The Encyclopedia of microscopy, Reinhold publishing corporation, New York.
6. Fisher R.A, 1950: Statistical methods of research workers.
7. Freumd J E, 1967: Modern elementary statistics, Prentice Hall, Inc. Englewood cliffs, N J.
8. Malter K, 1972: Statistical analysis in Biology, Chapmen Hall, London.
9. Campbej R C, 1975: Statistics for Biologists II nd Ed. Cambridge University Press, London.
10. Haftman E, 1967: Chromatography, Reinhold publishing corporation, New York.
11. Jones R M 1966: Basic microscopic techniques University of Chicago Press, Chicago.
12. Lenhoff E, 1966: Tools in Biology, Macmillan Co., New York.

*Refer recent edition


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M.Phil / Ph.D - BIOTECHNOLOGY

PART I - SYLLABUS
(For the candidates admitted from the academic year 201819 onwards)

PAPER-I - RESEARCH METHODOLOGY

UNIT I: INTRODUCTION TO RESEARCH METHODOLOGY

What is research? Basic and applied research, Essential steps in research, Defining the research problem, Research/Experimental design; Literature collection, Literature citation, Research report: Components, Format of thesis and dissertation, Digitalization and database; Manuscript/research article, Review monographs, Bibliography and Reference, Significance of research; Plagiarism: Definition, Limitation, Software packages.

UNIT II: BIOPHYSICAL METHODS

Analysis of biomolecules using UV/Visible, fluorescence, circular dichroism, NMR and ESR spectroscopy, structure determination using x-ray diffraction and NMR; Analysis using light scattering, different type of mass spectrometry and surface plasma resonance methods.

Radiolabeling techniques: Properties of different types of radioisotopes normally used in biology, their detection and measurement; incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material safety guidelines.

UNIT III: MICROSCOPIC TECHNIQUES

Visualization cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze-fracture methods for EM, image processing methods in microscopy.

Histochemical and Immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flowcytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization such as FISH and GISH.

UNIT IV: COMPUTATIONAL METHODS

Nucleic acid and protein sequence database; data mining methods for sequence analysis, web-based tools for sequence searches motif analysis – Primer designing – Next generation sequencing analysis - Molecular phylogeny - Drug designing - High throughput screening of pharmacological applications.

UNIT V: STATISTICAL METHODS Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); sampling distribution; difference between parametric and non-parametric statistics; confidence interval; errors; levels of significance; regression and correlation; t-test; analysis of variance; X2 test; basic introduction to Multivariate statistics – Software for statistics analysis: SPSS.

References

1. C.R. Kothari, II edition (2004) Research methodology, Methods and techniques, New Age International (P) Ltd, Publishers, New Delhi.
2. Jerrod H. Zar (1999) Biostatistical analysis by, Prentice Hall International, Inc. Press, London.
3. Attwood. T.K and Parry-Smith D.J. (2002) Introduction to Bioinformatics, Pearson education Singapore.
4. Sharma. BK. Instrumental methods of chemical analysis.
5. Upadhyay, Upadhyay and Nath, Biophysical chemistry.
6. Khandnur R.S. Handbook of biomedical instrumentation. Tata Mc Graw Hill.

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HPLC:

Principles of high performance liquid chromatography – Instrumentation - Pumps: types of pumps - requirements – Column packing : gradient elution, isocratic elution – Detectors for liquid chromatography – the mobile phase in HPLC – solvent degassing – column technology – column selection – quantitative analysis by HPLC-Applications.

UNIT-V Electroanalytical methods:

Redox potentials – definition – Methods of determination – applications – ion selective electrodes. Current – voltage relationships – polarography – instrumentation –Types of polarography– characteristics of DME – diffusion current – half wave potentials. Amperometric titrations - constant current coulometry – constant potential coulometry, cyclic voltammetry – basic principles and applications.

REFERENCES:

1. The art of Scientific Writing – H.F. Ebel, C. Bliefert and W.E. Russey 2nd ed Weinheim; Wiley-VCH (2004) .
2. R.C. Kapoor and B. S. Aggarwal - Principles of polography, 1st edition, Wiley (1991).
3. G. W. Ewing -Instrumental methods of chemical analysis, 4th edition McGraw-Hill (1975).
4. Analytical electrochemistry- Joseph Wang, 2nd edition wiley (2001).
5. Instrumental methods of analysis – H. Willard, L. Merritt Jr. and A. Dean. 4th Edn (1996)
6. Instrumental methods of chemical analysis – B.K. Sharma., GOEL PUBLISHERS 28TH EDITION (2012).
7. Fundamentals of analytical chemistry – D.A. Skoog and D. M. West. 7th Edu, Saunderson College Pub (1996)
8. Analytical chemistry – J.D. Dick. American Chemical Society (2007)
9. Basic concepts of analytical chemistry – S.M. Khopkar. New Age International, 1998.
10. Vogel's Textbook of Qualitative chemical analysis-5th edition.
11. Introduction of instrumental analysis (R. D. Braun,)(2009)
12. Principles of fluorescence spectroscopy – Joseph R. Lakowicz., 3rd edition Springer (2006).



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