



**FACULTY OF ARTS PH.D PROGRAM**

**ENGLISH**

**RESEARCH METHODOLOGY- SYLLABUS**

**Total Hours :60**

**Credits : 04**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports – Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit-II Mechanics of Writing**

Spacing, indentation and margin – Methodology in Bibliographical entries – names of persons, common and Latin abbreviations – Use of Acronyms and Alphabetism in the body- punctuations – Titles of works – Direct and in direct quotations – Ellipsis marks –Significance of round and square brackets, and underlining Use of (sic) in quotations.

**Unit- III Format of Empirical Thesis**

Experimental and Practical research-Purpose and significance of Empirical thesis –Choosing a field-Formulation of hypothesis – If experimental, at laboratories – new findings remaining unknown – If practical, preparing questionnaire on the basis of hypothesis – Collection of data through on the spot study – Findings by applying statistics – Arriving at a conclusion – Suggestions and recommendations. Computer applications in language research.

**Unit – IVIntroduction to Theoretical Perspectives**

Background to Contemporary Literary Theory, Russian Formalism, New Criticism, Feminism, Structuralism, Marxism, Modernism, Post-Modernism and Post-Colonialism

**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.



**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data

**PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

**PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

**DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

**References:**

- Nunan, D. (1992) Research Methods in Language Learning. CUP.
- Bachman, L.F. (2004) Statistical Analysis for Language Assessment. CUP.
- Kothari, C.P. (2009) Research Methodology: Methods and Techniques. New Delhi: New Age Publications.
- Mackay, A & S. M. Gass (2005) Second Language Research Methodology and Design. Mahwah, N. J : Lawrence Erlbaum.



- Sharma, B.A. V, Prasad, D. R. and Satya Narayan, P. (1983) Research Methods in Social Sciences. New Delhi: Sterling Publications Pvt. Ltd
- Bird,A.(2006). Philosophy of Science. Routledge.
- Macintyre, Alasdair (1967) A Short History of Ethics. London.
- P.Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
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- Beall,J.(2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
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**FACULTY OF SCIENCE PH.D PROGRAM  
BIOCHEMISTRY  
RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – IIMicroscopy and Analytical Instrumentations**

Principle,structure and applications of Bright field,Darkfield,Phasecontrast,Fluorescent,Electron microscopy (TEM & SEM),Confocalmicroscope and Foldscope.Atomic force microscope (AFM).pH meter-determination of pH,Colorimetry,Spectroscopy techniques – UV – Visible,Fluorescence,FTIR,Atomicabsorption,NMR,Massspectrometry,MALDIToF,IRspectrum, X-ray crystallography.

**Unit – III Bioinformatics**

Biological data bases – DNA sequence data bases & protein sequence data bases.Genome database – Mouse genome database.SRS-Similarity searching pair-wise sequence alignment – BLAST,FASTA.Dynamic programming – local and global alignment,Needlemanalignment.Multiple sequence alignment – Phylogeny.Structure database – Secondary structure prediction, Chou feat pass man,Neural network methods.Predicting 3 dimensional folds (Threading),Homology modeling,Molecular docking.

**Unit – IV Biostatistics**

Principles and practice of statistical methods in biological research – Data collection,presentation of Data – Measures of central tendency – Mean,Median,Mode,Correlation coefficient,Standarddeviation,student 't' test,chi-square test.Analysis of variance (ANOVA) and its uses.Basics of computers – types,servers,operating systems – Windows,UNIX and Linux.Finding scientific articles – Pubmed.Outline of SPSS and Mathematica.



## **Unit – V Research and Publication Ethics (Theory) (15 Hours)**

### **PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

### **SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

### **PUBLICATION ETHICS:(7 Hours)**

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### **RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)**

#### **OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

#### **PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

#### **DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.



## References

- Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
- Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
- Arora, P.N. & Malhon, P.K. 1996. Biostatistics. Imalaya Publishing House, Mumbai.
- Jogdand SN. 2004. Gene Biotechnology Published by Himalaya Publishing House, Mumbai.
- Baxevanis, A.D. & Ouellette, B.F.F. 2001. Bioinformatics: A practical guide to the analysis of genes and proteins – Wiley Inter science – New York.
- John G Webster. 2004. Bioinstrumentation .Student edition, John Wiley & sons, Ltd.
- Kleinsmith, L. J. & Kish, V.M. 1995. Principles of Cell and Molecular Biology. 2nd edn., McLaughlin, S., Trost, K., Mac Elree, E. (eds.), Harper Collins Publishers, New York.
- Keith Wilson & John Walker. 2003. Practical Biochemistry Principles & techniques. 5<sup>th</sup> edition, Cambridge university press.
- Palanivelu P. 2001. Analytical biochemistry and separation Techniques A Laboratory manual. 2nd edition, Published by Tulsi Book Centre, Madurai, Tamilnadu.
- Ramadass, P. and A. Wilson Aruni 2009. Research and Writing - Across the Disciplines. MJP Publishers, Chennai – 600 005
- Bird, A. (2006). Philosophy of Science. Routledge.
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- Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfm>
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**FACULTY OF SCIENCE PH.D PROGRAM  
BIostatISTICS  
RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours:60**

**Credits:4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports – Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – II Data Collection Techniques and Interpretation**

Collection of Data : Primary Data –Meaning,Secondary data –Meaning–Relevance's, limitations and cautions. Data Collection methods: Interview; Observation; Questionnaire,Developing tools –Validity (internal & external),Reliability of the tools.Meaning of InterpretationsTechniques of Interpretation,Precautions in Interpretations, Data Processing;Coding, tabulations, classifications.

**Unit – III Bioethics&Statistical Analysis**

Bioethics: Introduction, Animal rights and animal laws in India, Prevention of cruelty to animals Act1960, Biodiversity Act 2003. Concept of 3 R – conservation (Refined- to minimize suffering, Reduced –to minimize animals, Replaced – modern tools and alternate means) Animal use in research and education ,Laboratory animal use, care and welfare, animal protection initiatives- animal welfare board of India, CDSCO,CPCSEA, ethical commitment. Working with human: consent, harm, risk and benefits.

**Unit – IV Statistical Analysis**

Statistical analysis using MS office -Excel, SPSS, Epi –info, R Software, online softwares, Research management tools like Zotero/Mendeley.

**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

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**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

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**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

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**FACULTY OF SCIENCE PH.D PROGRAM**  
**CHEMISTRY**  
**RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

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**Unit – IIMicroscopy and Analytical Instrumentations**

Principle, structure and applications of Bright field, Darkfield, Phase contrast, Fluorescent, Electron microscopy (TEM & SEM), Confocal microscope and Foldscope. Atomic force microscope (AFM).pH meter-determination of pH, Colorimetry, Spectroscopy techniques – UV – Visible, Fluorescence, FT– IR, Atomic absorption, NMR, Mass spectrometry, MALDIToF, IR spectrum, X-ray crystallography.

**Unit – III Separation Techniques**

Centrifugation-preparative and analytical,ultracentrifugation,densitygradientcentrifugation.Principles and applications of gel – filtration,Ion- exchange,affinitychromatography;Thin layer and gas chromatography;High pressure liquid (HPLC) Chromatography,HPTLC,GC-MS,LC-MS.Electrophoresis – Principle,types and applications – PAGE (proteins),Agarose Gel Electrophoresis (Nucleic acids),Pulse field Gel Electrophoresis (PFGE),Two dimensional electrophoresis (IEF).

**Unit – IV Computing and Networking**

Introduction to computers and computing – hardware,Basic organization of a computer,CPU,Mainmemory,Secondarystorage,I/O device,Software,System and application software.Online search of Chemistry databases,e- journals,search engines for chemistry,chemweb.



**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

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- Sanjay Saxena, MS Office XP for Everyone, 1/e Vikas Publishing 2000
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**FACULTY OF SCIENCE PH.D PROGRAM**

**PHYSICS**

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Principle, structure and applications of Bright field, Darkfield, Phase contrast, Fluorescent, Electron microscopy (TEM & SEM), Confocal microscope and Foldscope. Atomic force microscope (AFM).pH meter-determination of pH, Colorimetry, Spectroscopy techniques – UV – Visible, Fluorescence, FT– IR, Atomic absorption, NMR, Mass spectrometry, MALDIToF, IR spectrum, X-ray crystallography.

**Unit – IIIStatistical Methods**

Interpolation – significance of interpolation – methods of interpolation – Binomial method – Newton's method – Newton's forward form – Newton's backward form –Finite differences – Lagrange's method – theoretical distribution – Binomial – Poisson – hypergeometric and normal distributions – data fitting-principle of least squares – fitting a straight line – curve fitting – Chi square test – conditions for applying Chi square test – uses and limitations.

**Unit – IV Introduction to Computing**

Introduction to computers and computing – hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software. Programming in C: Constants – Variables – Data types – Operators and Expressions – Input/Output Statements – Control statements – Functions – Arrays – One, two, multidimensional array declarations and initializations.



## **Unit – V Research and Publication Ethics (Theory) (15 Hours)**

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**FACULTY OF SCIENCE PH.D PROGRAM  
COMPUTER SCIENCE  
RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

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**Unit – II Algorithms and Analysis**

Elementary data Structures, Greedy method: Knapsack problem – Job sequencing with deadlines – Optimal merge patterns, Dynamic programming: Multistage graphs – Optimal binary search trees – 0/1 knapsack – Reliability design – the traveling salesperson problem – Flow shop scheduling, Basics search and traversal techniques: The techniques code Optimization – Biconnected components and depth – first search. Backtracking: The 8 – Queen s problem – Sum of subsets – Hamiltonian cycles –Knapsack problem.

**Unit – III Software Engineering**

Software Engineering process paradigms – Project management – Process and Project Metrics – Software estimation – Empirical estimation models – Planning – Risk analysis – Software project scheduling. Requirements Analysis and Design: Prototyping – Specification – Analysis modeling – Software design – Abstraction – Modularity – Software Architecture – Effective modular design – Cohesion and Coupling – Architecture design and Procedural design – Data flow oriented design – design patterns. User interface design – Human Computer Interface design – Interface design – Interface standards. Programming languages and coding – Language classes – Code documentation – Code efficiency – Software configuration Management-real time systems – Reverse Engineering and Re-engineering – CASE tools – Projects management, tools – analysis and design tools – Programming tools – integration and testing tools – clean room software engineering.





#### **Unit- IV Analytical Methods (Omit Theorem and Proof)**

Introduction – types of correlation – scatter diagram method – correlation graph method – coefficient of correlation – Spearman's Rank correlation coefficient – coefficient of concurrent deviation – correlation coefficient by the method of least square – Error of the coefficient of correlation – coefficient of determination. Introduction – graphic methods for studying regression – algebraic method of studying regression – Regression equation in case of correlation table – standard error of estimate – ratio of estimate.

#### **Unit – V Research and Publication Ethics (Theory)(15 Hours)**

##### **PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

##### **SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

##### **PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

##### **RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

##### **OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

##### **PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,



## **DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

### **References**

- Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
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- Roger Pressman. S Software Engineering “ A practitioner Approach 3rdEditonMcGraw Hill, 1997
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- Macintyre, Alasdair (1967) A Short History of Ethics. London.
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- National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press.
- Resnik, D.B.(2011).What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10. Retrieved from <https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfrn>
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- <https://doi.org/10.1038/489179a>
- Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7.<http://www.insaindia.res.in/pdf/EthicsBook.pdf>



**FACULTY OF SCIENCE PH.D PROGRAM  
MATHEMATICS  
RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports –Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – II Optimization**

Direct and gradient based methods for constrained and unconstrained optimization problems.

**Unit – III Applied Mathematics**

Fundamental properties of eigen values and eigen functions for symmetric kernels, Hilbert Schmidt theorem and some immediate consequences, solutions of integral equations with symmetric kernels.

**Unit – IV Computational Methods**

Numerical solution of linear and nonlinear ordinary differential equations, numerical solution of linear partial differential equations.

**Unit – V Research and Publication Ethics (Theory)(15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,



### **PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

### **RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

#### **OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

#### **PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

#### **DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

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- Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
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- Numerical Methods for Mathematics, Science and Engineering –J. W. Mathews-PHI.
- Introductory Methods of Numerical Analysis –S. S. Sastry –PHI.
- Numerical Solution of Partial Differential Equations –G. D. Smith.
- Bird,A.(2006). Philosophy of Science. Routledge.
- Macintyre, Alasdair (1967) A Short History of Ethics. London.
- P.Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
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- <https://doi.org/10.1038/489179a>
- Indian National Science Academy (INSA), Ethics in Science Education, Research and Governance (2019), ISBN:978-81-939482-1-7.<http://www.insaindia.res.in/pdf/EthicsBook.pdf>



**FACULTY OF SCIENCE PH.D PROGRAM**  
**MICROBIOLOGY**  
**RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports –Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – IIMicroscopy and Analytical Instrumentations**

Principle,structure and applications of Bright field,Darkfield,Phasecontrast,Fluorescent,Electron microscopy (TEM & SEM),Confocalmicroscope and Foldscope.Atomic force microscope (AFM).pH meter-determination of pH,Colorimetry,Spectroscopy techniques – UV – Visible,Fluorescence,FT– IR,Atomicabsorption,NMR,Massspectrometry,MALDIToF,IRspectrum,X-ray crystallography.

**Unit – III Separation Techniques**

Centrifugation-preparative and analytical,ultracentrifugation, density gradientcentrifugation.Principles and applications of gel – filtration,Ion-exchange,affinitychromatography;Thin layer and gas chromatography;High pressure liquid (HPLC) Chromatography,HPTLC,GC-MS,LC-MS.Electrophoresis – Principle,types and applications – PAGE (proteins),Agarose Gel Electrophoresis (Nucleic acids),Pulse field Gel Electrophoresis (PFGE),Two dimensional electrophoresis (IEF).Microbial Identification System (MIS).

**Unit – IV Biostatistics**

Principles and practice of statistical methods in biological research – Data collection,presentation of Data – Measures of central tendency – Mean,Median,Mode,Correlation coefficient,Standarddeviation,student ‘t’ test,chi-square test.Analysis of variance (ANOVA) and its uses.Basics of computers – types,servers,operating systems – Windows,UNIX and Linux.Finding scientific articles – Pubmed.Outline of SPSS and Mathematica.



**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

**PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

**PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

**DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.



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**FACULTY OF SCIENCE PH.D PROGRAM  
ZOOLOGY  
RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports –Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – IIMicroscopy and Analytical Instrumentations**

Principle,structure and applications of Bright field,Darkfield,Phasecontrast,Fluorescent,Electron microscopy (TEM & SEM),Confocalmicroscope and Foldscope.Atomic force microscope (AFM).pH meter-determination of pH,Colorimetry, Spectroscopy techniques – UV – Visible, Fluorescence, FT–IR,Atomicabsorption,NMR,Massspectrometry,MALDIToF,IRspectrum,X-ray crystallography.

**Unit – III Histological Techniques**

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

**Unit – IVBiostatistics**

Principles and practice of statistical methods in biological research – Data collection,presentation of Data – Measures of central tendency – Mean,Median,Mode,Correlation coefficient,Standarddeviation,student ‘t’ test,chi-square test.Analysis of variance (ANOVA) and its uses.Basics of computers – types,servers,operating systems – Windows,UNIX and Linux.Finding scientific articles – Pubmed.Outline of SPSS and Mathematica.

**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.



**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

**PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

**PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

**DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

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- <https://doi.org/10.1038/489179a>
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**COMMERCE & MANAGEMENT**  
**RESEARCH METHODOLOGY –SYLLABUS**

**Total Hours: 60**

**Credits: 4**

**Unit-I Research Methods**

Meaning of Research-Objectives of Research-Motivation in Research – Types of Research – Significance of Research –Research and Scientific Method– Criteria of good Research – Problem Encountered by Researchers in India – What is Research Problem? Selecting the Problem – Defining the Problem – Technique involved in Defining the Problem- Research Design – Different research design – Basic principles of Experimental Designs – Significance of Report Writing – Different Steps in writing Report – Layout of the Research Report – Types of Reports – Oral Presentation Mechanics of Writing a Research Report – Precautions for Writing Research Reports-Research metrics and Indexing.

**Unit – II**

Sampling design – Meaning – Concepts – Steps in sampling – Criteria for good sample design – Types of sample designs – Probability and Non-Probability samples – Sample size determination – Data collection – Data collection: Types of data – Sources – Tools for data collection – Constructing Questionnaire – Reliability and Validity – Pilot study – Data Pre-Processing : Coding and Editing data analysis: Exploratory, Descriptive and Inferential Analyses.

**Unit – III**

Test of significance: Parametric and Non-Parametric tests.Parametric tests –t test,F test and Z test – Non Parametric tests – U Test, Kruskal Wallis, Sign test – Multivariate Analysis – Factor analysis,Clusteranalysis,MDS,Discriminate Analysis Correlation and Regression analyses – Statistical Packages and its Applications – Other Tools of Model Building.

**Unit – IV**

Analysis and Interpretation – Significance – Points to be noted in Analysis and Interpretation – Report Writing-Layout of the Report – Types of Report – Steps in writing the Report – Foot note-Bibliography.

**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.



**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

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**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

**PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

**DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

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- P.Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865
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**FACULTY OF SCIENCE PH.D PROGRAM  
CLINICAL PSYCHOLOGY  
RESEARCH METHODOLOGY- SYLLABUS**

**Total Hours : 60**

**Credits : 04**

**Unit: 1 conceptualizing a research study**

Introduction to health research - Formulating research question, hypothesis and objectives - Literature review

**Unit: 2 Epidemiological considerations in designing a research study**

Measures of disease frequency - Descriptive study designs - Analytical study designs - Experimental study designs - Validity of epidemiological studies - Qualitative research methods: An overview

**Unit: 3 Bio-statistical considerations in designing a research study**

Measurement of study variables - Sampling methods - Calculating sample size and power

**Unit: 4 Planning a research study**

Selection of study population- Study plan and project management - Designing data collection tools - Principles of data collection - Data management - Overview of data analysis

**Unit – V Research and Publication Ethics (Theory) (15 Hours)**

**PHILOSOPHY AND ETHICS:(3 Hours)**

1. Introduction to philosophy: definition, nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

**SCIENTIFIC CONDUCT: (5 Hours)**

1. Ethics with respect to science and research
2. Intellectual honesty and research integrity
3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP)
4. Redundant publications: duplicate and overlapping publications, salami slicing
5. Selective reporting and misrepresentation of data

**PUBLICATION ETHICS:(7 Hours)**

1. Publication ethics: definition, introduction and importance
2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest
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5. Violation of



publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

**RESEARCH AND PUBLICATION ETHICS (PRACTICE)(15 HOURS)(INTERNAL)**

**OPEN ACCESS PUBLISHING:(4 Hours)**

1. Open access publications and initiatives 2. SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies 3. Software tool to identify predatory publications developed by SPPU 4. Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

**PUBLICATION MISCONDUCT:(4 Hours)**

(A) Group Discussions: 1. Subject specific ethical issues, FFP, authorship 2. Conflicts of interest, 3. Complaints and appeals: examples and fraud from India and abroad (B) Software tools: Use of plagiarism software like Turnitin, Urkund and other open source software tools,

**DATABASES AND RESEARCH METRICS:(7 Hours)**

(A) Databases: 1. Indexing databases 2. Citation databases: Web of Science, Scopus, etc. (B) Research Metrics: 1. Impact Factor of journal as per Journal Citation Report, SNIP, SIR, IPP, Cite Score 2. Metrics: h-index, g index, i10 index, altmetrics.

**Books and References**

1. World Health Organization. Health research methodology: a guide for training in research methods. Manila: WHO Regional Office for the Western Pacific; 2001: p.1-10.
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**FACULTY OF ARTS PH.D PROGRAM  
BIOTECHNOLOGY  
RESEARCH METHODOLOGY- SYLLABUS**

**Total Hours :60**

**Credits : 04**

**Unit I Research Methodology**

Meaning, types and objective of research, Selection of Research, methodology- philosophical, descriptive and experimental methods, Developing the hypothesis, Research process planning and conducting. Review of Literature: Procedure and steps for preparing review; Data collection:- Types of data, Sources, Methods of data collection, Constructing questionnaire, Establishing reliability and validity, Data processing:- Coding, Editing, displaying of data by tables and graphs. Thesis layout:- Preliminaries, Text of the thesis-Format and conventions, charts and diagrams, Norms for using Index and Bibliography. Scientific Writing: Scientific Document; Organization and writing of research paper, Types of Scientific Communication, short communications, monographs, technical and survey reports, Importance of publishing research paper.

**Unit II Molecular Techniques**

Isolation and Identification of bacteria and fungi strains; Extraction: genomic DNA and RNA; Sequencing: 16S rRNA & 18S rRNA; Recombinant DNA techniques and Genomics: Restriction and modification enzymes in cloning; PCR; DNA sequencing methods (Sanger's chain termination and automated DNA sequencing method); Next generation sequencing (NGS); Global expression profiling; Whole genome analysis of mRNA and protein expression; Real time PCR and Microarrays and their applications; ELISA, RIA, Hybridoma Technology, Q-PCR, EST analysis, DNA microarrays, Serial Analysis of Gene Expression (SAGE), RNA-Seq and in-situ hybridization.

**Unit III Analytical techniques**



Chromatography techniques: gel filtration, Ion exchange, affinity, HPLC, FPLC; Electrophoresis techniques- SDS, AGE, IEF, Western blot, Northern blot; Software Tools: BLAST, Q-Pulse, EMBOSS, Clustalw. Spectroscopy techniques: UV-Vis, Fluorescence, CD, FTIR, NMR, X-ray crystallography, SPR, SEM, TEM, FETEM, LCMS, GCMS.

#### **Unit IV Statistical Analysis**

Introduction and Types of Sampling, Sampling Methods, Sampling and Non-Sampling Errors, Binomial and Poisson Distribution, Exponential, Beta & Normal Distribution, Procedure of Testing a Hypothesis, Significance Test in Attributes, Significance Test in Variables (Small and Large samples) Partial & Multiple Correlation, Multiple Regression Analysis Chi-Square Test, Sign Test & Median Test, Multivariate Analysis Technique, Analysis of Variance (ANNOVA), Description of SPSS software and uses.

#### **Unit V Research and Publication Ethics**

PHILOSOPHY AND ETHICS: 1. Introduction to philosophy: definition, nature and scope, concept, branches 2. Ethics: definition, moral philosophy, nature of moral judgments and reactions.

SCIENTIFIC CONDUCT: Ethics with respect to science and research 2. Intellectual honesty and research integrity 3. Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP) 4. Redundant publications: duplicate and overlapping publications, salami slicing 5. Selective reporting and misrepresentation of data,

PUBLICATION ETHICS: 1. Publication ethics: definition, introduction and importance 2. Best practices / standards setting initiatives and guidelines: COPE, WAME, etc. 3. Conflicts of interest 4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types 5. Violation of publication ethics, authorship and contributorship 6. Identification of publication misconduct, complaints and appeals 7. Predatory publishers and journals

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### References:

1. Ausubel FW. Current Protocols in Molecular Biology. Wiley-Blackwell. 2011. Print
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5. Wilson K. and Walker J. Principles and Techniques of Biochemistry and Molecular Biology. 7th edition. Cambridge University Press India Pvt. Ltd. 2010. Print
6. Molecular Biology by David P. Clarke, 2012. 2. Molecular Cloning: A laboratory manual by Joseph Sambrook & David Russell, 2001.
7. DNA Technology: The Awesome Skill by I. Edward Alcamo, 2001.
8. Molecular Biology of the Gene by James Watson, Tania Baker, Stephen Bell, Alexander Gann, Michael Levine & Richard Losick, 2007.
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**Unit II Bioinformatics Databases**

Genome Databases: ICTVdb, GOLD, MGD; Genome Browsers:- Ensembl, VEGA genome browser, NCBI-NCBI map viewer, KEGG, MIPS, UCSC Genome Browser; Sequence Databases:- GenBank, EMBL, DDBJ; Swiss-Prot, TrEMBL, UniProt, Sequence motifs Databases:- Prosite, ProDom, Pfam, InterPro, Structure and derived databases – PDB, NDB, MMDB; SCOP, CATH, FSSP, CSA; KEGG ENZYME database; STRING; Pubchem. Database search engines – Entrez, BLAST, FASTA, ScanProsite and eMOTIF, VAST and DALI, EMBOSS. Literature Databases:- Open access and open sources, PubMed, PLoS, Biomed Central, etc.; Bioinformatic Resources:- NCBI, EBI, ExPASy, RCSB.

**Unit III Molecular Analysis**



Sequence Analyses – Sequence similarity, homology and identification; Scoring matrices: PAM and BLOSUM; Algorithms: Smith and Waterman algorithms, pairwise alignments. Multiple sequence alignments (MSA) Algorithms: BLAST, FASTA, CLUSTALW, PSI-BLAST and PHI-BLAST analyses. Molecular Phylogenetics : Phylogenetic Tree Construction, Gene Phylogeny, Species Phylogeny; Distance measurements, Phylogenetic Tree Evaluation, Phylogenetic Programs: MEGA and PHYLIP; Macromolecular Drug Design and Simulations: Nucleic Acids (DNA and RNA); Proteins structure analysis: Primary, Secondary, super secondary, Tertiary and Quaternary structure; Validation of Protein Structure: Ramachandran Map, Chou Fasman; Molecular Dynamics: Force Fields: AMBER, CHARMM, Merck, Auto Dock, Pymol, Gromacs and CNS

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**References:**

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