



VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

Faculty of Arts Ph.D Program English

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 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.



VINAYAKA MISSION'S RESEARCH FOUNDATION

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Unit – IV Introduction 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.



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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
- 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.cfm>
- Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
- <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/Ethics Book.pdf](http://www.insaindia.res.in/pdf/Ethics%20Book.pdf)



**VINAYAKA MISSION'S
RESEARCH FOUNDATION**
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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,FT-IR,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 co-



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efficient, Standard deviation, 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)

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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. 5th 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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Faculty of Science Ph.D Program BIOSTATISTICS

RESEARCH METHODOLOGY –SYLLABUS

Total Hours: 60

Credits:4

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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 Interpretations Techniques 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



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Statistical analysis using MS office -Excel, SPSS, Epi –info, R Software, onlinesoftwares, 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)

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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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**VINAYAKA MISSION'S
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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,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).



Unit – IV Computing and Networking

Introduction to computers and computing – hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, 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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- Jogdand SN. 2004. Gene Biotechnology Published by Himalaya Publishing House, Mumbai.
- K.Balagurusamy, Fortran for Beginners Tata McGrawhill, New Delhi 1990
- K.V.Raman Computer in Chemistry, Tata McGrawhill, New Delhi 1990
- Balagurusamy C++ Tata McGrawhill, New Delhi 1995
- Sanjay Saxena, MS Office XP for Everyone, 1/e Vikas Publishing 2000
- Manual of M.S Office Microsoft Inc.
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VINAYAKA MISSION'S RESEARCH FOUNDATION

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Faculty of Science Ph.D Program PHYSICS

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 – 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,Mainmemory,Secondarystorage,I/O device,Software,System and application software.Programming in C: Constants – Variables – Data types – Operators and Expressions –



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Input/Output Statements – Control statements – Functions – Arrays – One, two, multidimensional array declarations and initializations.

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- K.V. Raman Computer in Chemistry, Tata McGrawhill, New Delhi 1990
- Sanjay Saxena, MS Office XP for Everyone, 1/e Vikas Publishing 2000
- Manual of M.S Office Microsoft Inc.
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Faculty of Science Ph.D Program

COMPUTER SCIENCE

RESEARCH METHODOLOGY –SYLLABUS

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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 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



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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



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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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- K. R. Gupta, Statistics – Volume 1, Atlantic Publishers and Distributors, 2014. (Chapters 8 and 9)
- Roger Pressman. S Software Engineering “ A practitioner Approach 3rdEditonMcGraw Hill, 1997
- P Fleegeer “Software Engineering’ Prentice Hall, 1999
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- 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/Ethics Book.pdf](http://www.insaindia.res.in/pdf/Ethics%20Book.pdf)



VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

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.



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(Deemed to be University under section 3 of the UGC Act 1956)

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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- 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.
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- Beall, J.(2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
- <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/Ethics Book.pdf](http://www.insaindia.res.in/pdf/Ethics%20Book.pdf)



**VINAYAKA MISSION'S
RESEARCH FOUNDATION**
(Deemed to be University under section 3 of the UGC Act 1956)

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 – II Microscopy 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 co-



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efficient, Standard deviation, 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.



VINAYAKA MISSION'S RESEARCH FOUNDATION

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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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- 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/Ethics Book.pdf](http://www.insaindia.res.in/pdf/Ethics%20Book.pdf)



VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

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 – 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,

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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,

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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.cfm>
- Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 179-179.
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**VINAYAKA MISSION'S
RESEARCH FOUNDATION**
(Deemed to be University under section 3 of the UGC Act 1956)

Faculty of COMMERCE & MANAGEMENT

Ph.D Program

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, Cluster analysis, MDS, Discriminate Analysis Correlation and Regression analyses – Statistical Packages and its Applications – Other Tools of Model Building.

Unit – IV



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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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