SYLLABUS

M.Phil. / Ph.D. Course work

(*w. e. f. academic year 2021-22 and onwards)*

Department of Physics
&
All research centres in Physics
Affiliated to
Savitribai Phule Pune University
(Formerly University of Pune)

Prof. Gotan Jain
Chairman
BOS (Physics), SPPU

Prof. Sandesh Jadkar
Head
Dept. of Physics, SPPU

Prof. Vikas Mathe
Member
Dept. of Physics, SPPU

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Savitribai Phule Pune University

(Formerly University of Pune)

Syllabus for M.Phil. / Ph.D. Course work: Physics
(*w. e. f. academic year 2021-22 and onwards*)

I. *The total number of credits for M.Phil. / Ph.D. shall be 18*
II. *The course work will be treated as pre-requisite for M.Phil./ Ph.D. programmes.*
III. *The M.Phil./ Ph.D. course work shall consist of the following components, structure and the respective credits.*
IV. *All other rules and regulations regarding the course work shall be adhered as per* Savitribai Phule Pune University *(SPPU), Pune and University Grants Commission (UGC), New Delhi.*

M.Phil. / Ph. D. Course Structure for Physics:

The syllabus will be applicable to all the research centres offering M.Phil./Ph.D. programme in Physics affiliated to the Savitribai Phule Pune University. The course work shall be of 18 credits-

Sr. No.	**Course Code**	**Name of the Subject**	**Credits allotted**	**No of Hours**
1	**Course 1** Phy-Ph.D. 001	Research Methodology.	**04**	**60**
2	**Course 2** Phy-Ph.D. 002	i. Writing research proposal for obtaining financial assistance from national funding agencies, reviews and Seminars.	**01**	**15**
		ii. Writing of Reviews	**01**	**15**
		iii. Seminars	**02**	**30**
3	**Course 3** Phy-Ph.D. 003	Subject specific advanced level course- A) Fundamentals of Physics Revisited B) Advanced Experimental Techniques	**04** **04**	**60** **60**
4	**Course 4** Phy-Ph.D. 004	Publication Ethics *Research centre can have their own course to be run and evaluate* OR *Research centre can adopt a payment basis Publication ethics online course run by the Centre of Publication Ethics*	**02**	**30**
		TOTAL CREDITS	**18**	**270**
Course structure as per University circular available on following link: ***http://collegecirculars.unipune.ac.in/sites/documents/Revised%20PhdMPhilSyllabus2020/M.Phil.Ph.D.%20Course%20Work_04.06.2021.pdf***				

COURSE 1.

Course Code: Phy-Ph.D. 001
Title- Research Methodology.
Credits: 04 (60 hours)

This course is designed by the university for all faculties, which is available on the following link on the university website.

http://collegecirculars.unipune.ac.in/sites/documents/Revised%20PhdMPhilSyllabus2020/Research%20Methodology%20Revised%20Syllabus%20(%20Ph.D.%20Course)_08.092020.pdf

Based on the recommendation for the Physics subject under the faculty of Science and Technology following course is applicable.

Purpose - This course is one of the common courses that will train the M.Phil./Ph.D. student to do research efficiently.

Need of the course - It is observed that most of the M.Phil./Ph.D. entrants are not aware of the philosophy behind the research. Students face many questions such as why a research study has to be undertaken, how the research problem has to be defined, in what way and why the hypothesis has to be formulated, what data has to be collected, which method/technique has to be adopted, why specific technique of analysing data has to be used and a host of similar other questions while performing their research. The present course will facilitate the students to address these issues which help them to execute quality research.

Structure of the course – The course is structured into four different modules. The contents are largely case based so that student understands the practical workability of the course.

Sr. No.	Contents	Credits allotted	No of Hours
1	**Module I** - History of research. Indian, Egyptian, Greek ideas methodologies and research in agriculture, chemistry, metallurgy, medical. Ancient Indian research methodology applications.	01	15
2	**Module 2** - Statistical analyses and its significance, Exploratory and confirmatory research, Planned and ad-hoc methods of data collection, Non-response and methods of recovering the missing response, Various software for statistical analysis. The module will consist of case studies of the research performed in various subjects using statistical methods, Error and noise analysis, curve fitting.	01	15
3	**Module 3** – Literature search, selection of research topic (case study based), maintaining laboratory records (case study based). Safety in Laboratories, Ethical considerations, effective verbal and non-verbal communication, field data collection, safety in field.	01	15
4	**Module 4**- Writing research paper and/or thesis, making a presentation, writing a research proposal, and patents in Science, technology	01	15

The contact hours for the course will be 60 hours. The examination for the course will be conducted separately

References:

1) 'History of the Scientific Methods' by Martin Shuttleworth, https://explorable.com/history-of-thescientific-method.
2) 'The Statistical Analysis of Experimental Data' by, John Mandel, ISBN: 0486646661, ISBN13: 9780486646664

Mode of examination

The internal examination of the course will be separately conducted. The examination mode is decided by the instructor of that course.
The external examination will be conducted at the time of 4th half yearly progress review. The student's implementation of various aspects in research methodologies will be checked.

COURSE 2.

Course Code: Phy-Ph.D. 002
Title- Scientific Writing and Presentation Techniques
Credits: 04 (60 hours)

Purpose – To train the research student to write and present his/her research topic in scientific manner.
Need of the course – Special training to the research students is required for writing review articles and research proposals to get financial assistance. For effective scientific presentation extensive seminar activities are essential. Since the research topic of every student is different, individual training, for both writing and presentation skills, is required to be given by the Research Guide.
Structure of the course – The course is structured into three different modules. The contents are distinct for individual research student.

Sr. No.	Contents	Credits allotted	No of Hours
1	**Module 1** Writing research proposal for obtaining financial assistance from national/international funding agencies- Can include Title, Research Context and Rationale, Research questions, Methodology, Plan of work, Significance of research, Bibliography. As per the requirement or proforma of the funding agencies.	01	15
2	**Module 2** Writing of Reviews- Respective guide should assign and check.	01	15
3	**Module 3** Seminars- At least 3 seminars should be conducted by the guide. Can include - Communication skills (Writing and Oral)-Listening, Speaking and Reading, presentation skills and ethics, Public speaking, workplace communications.	02	30

Mode of examination

Research guide should teach and evaluate this course for each student separately.

COURSE 3

Course Code: Phy-Ph.D. 003A and 003B

Title- Subject specific advanced level course

Phy-PhD 003A: Fundamentals of Physics revisited (04 credits)

Phy-PhD 003B: Advanced Experimental Physics (04 credits)

Credits: 08 *(04 each; 60 + 60 hours)*

Subject - Phy-PhD 003A: Fundamentals of Physics revisited (04 credits)

Purpose – To revise the fundamentals of Physics useful for research

Need of the course – For doing research in any advanced topics it is essential to have thorough background of basics related to the subject. This course is designed in such a way to train a student to meet the essentials of the advance course.

Structure of the course – The course consists of seven modules related to basic physics namely Mathematical methods in physics, Classical mechanics, Electrodynamics, Quantum mechanics, Statistical mechanics, Nuclear and Particle physics and Atoms, Molecules and Solids.

Sr. No.	Contents	No of Hours
1	**Mathematical Methods in Physics:** Application of vector calculus in classical mechanics and electrodynamics. Vector spaces and operator algebra, matrices and their application in quantum mechanics, Linear first order and second order differential equations in physics, Fourier series, Fourier and Laplace transforms, Complex analysis its applications in evaluating integrals.	8
2	**Classical Mechanics:** Lagrange's and Hamiltonian Formalisms, Conservation theorems and symmetry properties, Two- body central force problem- reduction to one body problem, scattering in a central force field. Small oscillations, orthogonal transformations, Eulerian angles, Rigid body motion.	8
3	**Electrodynamics:** Laplace and Poisson equations, boundary value problems, method of images, Electrostatics in dielectric media, Ampere's theorem. Bio-Savart law, electromagnetic induction, Maxwell's equations in free space and in linear isotropic media, Boundary conditions on fields at interfaces, scalar and vector potentials. Gauge invariance. Electromagnetic waves - reflection and refractions, dispersion, interference, coherence, diffraction, polarization, electrodynamics of charged particles in electric and magnetic fields. Time varying fields, plane electromagnetic waves in non-conducting media. Radiation from moving charges and from a dipole, retarded potentials and fields.	8
4	**Quantum Mechanics:** One dimensional problems, Harmonic oscillator, hydrogen atom, spherically symmetric potential: bound states and scattering states, angular momentum algebra, time independent and time dependent perturbation theories, WKB approximation, identical particles and symmetry, quantization of electromagnetic field (Coulomb gauge), Kramers-Heisenberg formula, Thomson, Raleigh and Raman scattering	8

5	**Statistical Mechanics:** Probability theory, statistical description of macroscopic systems, phase space, ensembles, partition function, laws of thermodynamics, thermodynamic potentials and Maxwell's relations. Chemical potential, free energy and connection with thermodynamic quantities. Ideal gas, Classical and quantum statistics, degenerate electron gas, BoseEinstein condensation, realization of Bose-Einstein condensate in the laboratory.	8
6	**Nuclear and Particle physics:** Basic nuclear properties, liquid drop model, nuclear forces, nuclear shell structure, interaction of charged particles and electromagnetic radiation with matter, basic principles of particle detectors, radio-active decays, nuclear reactions, fundamental forces, Gellmann-Nishijima formula Quark model, CPT invariance in different interactions, parity non-conservation in weak interactions.	8
7	**Atoms, Molecules and solids:** Electrons in atoms, exchange symmetry of wavefunctions, atomic and molecular spectra and their explanations including spin-orbit coupling, fine structure, relativistic corrections, spectroscopic terms and selection rules, hyperfine structure, Zeeman, Paschen-Back and Stark effects. Crystal classes and systems, lattice vibration, free electron theory, energy bands in solids, electronic structure of quantum confined structures, impurity levels in doped semiconductor structures. Electron transport, dielectrics, Clausius-Mosstti equation, ferroelectricity, dia-, para, ferro-, antiferro- and ferri-magnetism, superconductivity	12

References:

1) Mathematical Methods for Physicists A comprehensive Guide, George B. Arfken, Hans J. Weber and Frank E. Harris, (Academic Press Elsevier)
2) Classical Mechanics, N. C. Rana and P. S. Joag (Tata McGraw Hill)
3) Introduction to Electrodynamics, David J. Griffiths, (Prentice Press)
4) Quantum Physics, Stephen Gasiorowicz (John Wiley & Sons Inc.)
5) Fundamentals of statistical and thermal physics, Fedrick Reif (McGraw Hill)
6) Concepts of Nuclear Physics, B.L. Choen (Tata McGraw Hill)
7) Quantum Physics, Robert Eisberg and Robert Resnick, (John Wiley and Sons)

Mode of examination

The examination mode is decided by the teachers of this course or research centre will have their own mode of conduction of the examination.

Subject - Phy-Ph.D. 003B: Advanced Experimental Physics (04 credits)

Purpose – To train the students for various tools to be used during the course of time.

Need of the course – During the course of research work to execute the objectives of the research problem it is essential to understand the basics of the experimental techniques for proper measurements and analyses.

Structure of the course – The course consists of four different modules, which covers different aspects of advanced experimental techniques.

Sr. No.	Contents	No of Hours
1	**Module 1: Interaction of radiation and energetic particles with matter** Basic phenomena in case of low energy and high energy interactions (keV and MeV energies) of photons, γ-rays, electrons, protons, neutrons, ions etc. Applications of these processes in synthesis of thin films, coatings, evaporation, sputtering (like plasma, processing, ion-beam processing, LASER processing) and in X-ray photoelectron spectroscopy (XPS).	15
2	**Module 2: Spectroscopic Techniques** Resolution of spectrometer/ instrument (general), Resolving power and influence of different experimental parameters on it. Sensitivity of Measurement. Accuracy of measurements. Instrumental errors and measurement errors. Atomic and molecular spectroscopy UV-vis-NIR absorption spectroscopy, Electronic transition in solids, Transmission reflection and absorption coefficient Infrared spectroscopy, Molecular vibration spectroscopy, Rotational spectroscopy, Bond analysis. Raman spectroscopy. Resonance spectroscopy Angular momentum, Magnetic moments and energy levels, Magnetic resonance, Nuclear Magnetic Resonance, Chemical shifts Fine structure and Intensity variations. Mossbauer spectroscopy Analysis of the spectra.	15
3	**Module 3: Microstructural analysis techniques** Atomic absorption, emission spectroscopy - fundamental of optical atomic spectrometry, Atomic emission spectroscopy. Atomic fluorescence spectrometry. Comparison of Atomic spectroscopies. X-ray diffraction principles, structure factor and diffraction intensity calculations, Rietveld analysis. Scanning electron and Transmission electron microscopy, Field emission microscopy, scanning Tunnelling microscopy, Atomic force microscopy.	15
4	**Module 1: Essentials of measurement and analysis** Noise and Signal handling Signal to noise ratio, Johnson Noise and Nyquist theorem, Shot noise, Means of reducing noise. Grounding – shielding, pre-amplifier, Considerations sampling theorem, filters – ADCs/DACs Foamier Transform, Laplace and Fast Fourier Transforms. Data analysis Lorentzian, Gaussian, least square fitting of the spectra. (curve fitting) Deconvolution of spectrum, Derivative peak shapes, Analysis of spectra by taking examples of Raman, X-ray photo-electron, etc. spectra.	15

References:

1. Introduction to analysis and processing of signals, Paul Lynn, Howard W. (Sams and Company, 1983).

2. Probability, Random Variables and Stochastic Process, A. Papoulis, international student Edition (McGraw-Hill International Book Company, 1984)
3. *Vacuum Physics and Techniques,* T. A. Delchar, Chapman and Hall.
4. *Vacuum technology,* A. Roth, (North Holland, Elsevier Science B.V. 1990)
5. *High vacuum techniques,* J. Yarwood, (Chapman and Hall, Londong, 1967)
6. *Nuclear Radiation Detectors,* S.S. Kapoor, V. S. Ramamurthy, (Wiley-Eastern Limited, Bombay)
7. *Experimental Principles and Methods below 1K,* O. U. Lounasmaa, (Academic Press, London and New York, 1974)
8. *Thermometry at ultra-low temperatures,* W. Weyhmann in Methods of Experimental Physics, Vol. II (R. V. Coleman, Academic Press, New York and London, 1974).
9. *Cryophysics,* K. Mendelssohn, Interscience (London, 1960)
10. *Characterization of Materials,* John B. Wachtman & Zwi. H. Kalman, Pub. Butterworth Heinemann (1992)
11 Handbook of Spectroscopy, G. Gauglitz and T. Vo-Dinh (WILEY-VCH Verlag GmbH & Co, 2003)

Mode of examination

The examination mode is decided by the teachers of this course or research centre will have their own mode of conduction of the examination.

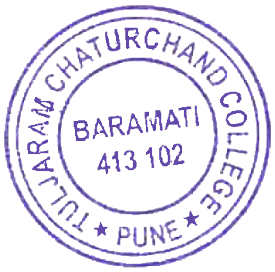
COURSE 4.

Course Code: Phy-Ph.D. 004
Title- Publication Ethics.
Credits: 02 (*30 hours)*
Research and Publication Ethics:
Two Credit course, approved by UGC and compulsory for all Ph.D. students. The link for the same is given below.
http://sppudocs.unipune.ac.in/sites/circulars/MPhilPhDAdmission%20Circulars/Research%20and%20Publication%20Ethics.pdf?Mobile=1&Source=%2Fsites%2Fcirculars%2F%5Flayouts%2Fmobile%2Fdispform%2Easpx%3FList%3Df5fad69e%252Dd3e8%252D4ac5%252D90f6%252D0786c34fce20%26View%3D0ea15891%252D5dd2%252D436a%252Dbe77%252D0bedc1d2817a%26ID%3D186%26CurrentPage%3D1

Sr. No.	Contents	No of Hours
Theory		
1	Philosophy and Ethics	4
2	Scientific Conduct	4
3	Publication Ethics	7
Practice		
1	Open Access Publishing	4
2	Publication misconduct	4
3	Database and Research Metrics	7
	Total	**30**

Mode of examination

The examination mode is decided by the teachers of this course or research centre will have their own mode of conduction of the examination.



University of Pune

Ph.D. Course Work in Botany 2010-11

Each course will be of 5 Credits and equally assessed for internal and external

PHD BO 101 : Research Methodology

1. Research Methodology-literature review, defining problem, approach and methodology, Documentation and presentation of data, analysis of interpretation of data, manuscript preparation.
2. Quantitative methods: biostatistics used for analysis of data
3. Computer application :bioinformatics, databases and their application
4. Tools and techniques: biochemical and biophysical techniques, microscopic techniques. Anatomical and Histochemistry.
5. Working and principles of various analytical instruments.
6. Pharmacognosy techniques.

PHD BO 102 : Advances in Botany-I

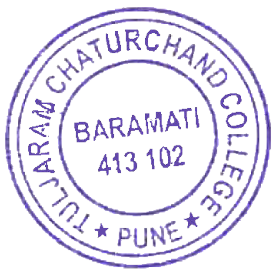
1. Plant-animal and plants-microbes interaction
2. Biodiversity: genetic, species, molecular diversity and taxonomy, DNA bar coding, population genetics, conservation of biodiversity and endangered species, Evolution.
3. Climate change and carbon sequestration
4. Algal Biofuels
5. Remediation of degraded/contaminated ecosystem by plants microbes
6. Recent nomenclature of Plants

PHD BO: 1.3 Advances in Botany-II

1. Advanced in plant science w.r.t. secondary metabolite production
2. Genetically modified plants for improved tolerance to biotic abiotic stress
3. Molecular generics of plant development
4. Mechanism of plant hormone action
5. Signal transduction in plants

PHD BO : 1.4 Special Course

This course will be handled by Guide/Supervisor of the student. Concerned teacher will assign topics for review and seminar other than the topic of Ph.D. student will have to submit the review the seminar write-up to HOD/Coordinator which will be assessed by expert. This will be followed by presentation and will be assessed by group of teachers.



Department of Microbiolgy

Savitribai Phule Pune University

Ph.D. course work in the **Subject of Microbiology**.

1] **Coursework Structure:** The coursework shall be of total **16 credits** divided into three courses. One credit shall be equal to 15 hours of contact time.

- **Course I: Research Methodology- Compulsory (4 credits)**
  Research methodologies adapted for designing, executing and publishing a research work.
- **Course II: Scientific writing and communication – Compulsory (4 credits)**
  Activity based course- Writing research grant proposal, review article, and presenting research papers.
- **Course III: Subject specific advanced level courses- Elective (8 credits)**
  These courses are designed to impart skills and knowledge in advance research methodologies, to impart hands on experience or demonstration of different techniques and instrumentations used in biological sciences, to analyze and interpret data obtained.

2] **Coursework Flexibility:**

- Department conducting the coursework may decide the optional courses to be floated.
- Candidates may opt for equivalent online courses floated on Swayam platform with permission of the guide, coursework coordinator/s and Head of the Institute/ department.
- University Department Research center may introduce additional optional course/s on recommendations of the Departmental Committee. The syllabus of the optional course will be prepared by the concerned teacher and will be flexible to accommodate new developments in that area. Whenever such an optional course is floated, the concerned syllabus will be discussed and approved in the Departmental Committee and forwarded to the Board of studies.
- If found necessary, course work may be carried out by candidates in sister Departments/Institutes either within or outside the University for which due credit will be given to them. However, the candidate can opt for such a course upon recommendation of the Guide, Ph.D. coursework coordinator/s and Head of the Institute/ department.

3] **Coursework exemption:** Only those candidates who have completed M.Phil. from any Statutory University and whose admission at M.Phil. was done through an Entrance Examination and Course work was prescribed for M.Phil. level, shall be exempted from the Course work.

4] **Coursework Evaluation**: The policies and procedures determined by the University shall be followed for the conduct of examinations and declaration of the result of the candidate. The passing for each paper shall be 50%. The Head / Director of the department/institute shall communicate the result to the Ph.D. section of SPPU.

Course No.	**Title of the course**	**No. of credits**	**Internal Marks**	**External Marks**	**Total Marks**
PCI	Research Methodology (Compulsory)	4	50	50	100
PCII	Scientific writing and communication (Compulsory)	4	50	50	100
PCIII	Subject specific advanced level courses (Elective)	8 (2/course)	100 (25/course)	100 (25/course)	200 (50/course)
Total		16	200	200	400

5] Course Details:

Course No.	Course Name	Credits
PC I	**Research Methodology:** • **History of research.** Indian, Egyptian, Greek ideas methodologies and research in agriculture, chemistry, metallurgy, medical. Ancient Indian research methodology • **Biostatistics** for qualitative and quantitative analysis of biological data and its interpretation. Statistical analysis and its significance. Various software for statistical analysis (Origin, Statistical Package for the Social Sciences (SPSS), MATLAB, Microsoft Excel, Statistical Analysis Software (SAS), GraphPad Prism, Minitab). This module will consist of case studies of the research performed in various subjects using statistical methods, Error and noise analysis, curve fitting • **Rules and regulations to be followed for research:** Safety in Laboratories, Ethics in research conduct (Institutional biosafety, Human and Animal Ethics, National Biodiversity Act). Ethics in research publication (Authorship, Competing interests, Plagiarism, Simultaneous submission, and Research fraud). • **Literature survey:** Referencing at institutional and national libraries, web-based search engines to survey scientific literature and databases (Google Scholar, Science Direct, Medline-Pubmed, Web of science, Cochrane, EMBASE etc.). • **Publishing Research:** Structure of research proposals, patents, thesis, and research publications, Making oral and poster presentation. Journal selection (UGC-CARE listed, SCIE listed, JCR listed), Measures of Indexing (Impact Factor, H-Index, i10 index, citation Index etc.). • **Research Techniques:** Spreadsheet tools (features, using formulas and functions for statistical analysis, making graphs and charts), Power point presentations, tools for digital image processing and preparation of graphical abstracts (GIMP, ImageJ, Biorender, Chemdraw, Adobe illustrator etc.), tools for managing references (Zotero, Mendeley, Reference Manager, Endnote etc.)	**4**
PC II	**Scientific writing and communication** • Writing a review article OR Scientific Paper (to be internally evaluated by respected research guide) (1 credit) • Preparing a Grant Proposal (to be evaluated by respected research guide) (1 credit) • Research paper presentations: The candidate shall present at least three research papers. To be evaluated by the external committee appointed by the research center conducting the coursework. Marks for the best two presentations shall be considered (2 credits)	**4**

PC III	Subject specific advanced level courses	8
PCIII-M1	**Advanced Spectroscopy** Principle, working, applications and data analysis of following • UV Visible Spectroscopy • Fluorescence spectroscopy • Fourier-transform infrared spectroscopy • Mass spectroscopy • Nuclear magnetic resonance • X ray diffraction	**2**
PCIII-M2	**Bioinformatics** • Introduction and biological databases Nucleic acid, proteins, genomes— structure data bases, search engines, sequence data forms and submission tools, scoring matrices for sequence alignments, algorithms pairwise sequence alignments, database similarity searches-BLAST, FASTA • Gene bank sequence database; submitting DNA sequences to databases and database searching; sequence alignment; pairwise alignment techniques, Multiple sequence alignment, phylogenetic analysis and tree building methods, motif searches, epitope prediction, data mining tools and applications, promoter and gene prediction, comparative analysis • Demonstration of databases (GENBANK, PDB, OMIM) and software (RASMOL, Ligand Explorer) • Phylogenetic prediction. Sequence Analysis, Sequence alignment, Primer Designing, Mass Spectrometry based proteomics tools, Protein structure & functions prediction tools: Modeling: 2D and 3D protein modeling. System Biology approach to understand microbial enzyme machinery.	**2**
PCIII-M3	**Cell Culture Techniques** • **Animal Culture:** Media requirements and sterilization techniques, primary and established cell lines. Culture methods: hanging drop, monolayer and suspension. Advantages and disadvantages. Scale up methods. Roux tubes roller bottles. Stem cells: adult and embryonic, applications to tissue engineering. Applications of animal cells. • **Plant tissue culture:** Cell and callus culture, anther culture. Micro-propagation, somatic cell hybridization, protoplast fusion, cybrids, artificial seeds, Agrobacterium mediated gene transfer and use of Ti plasmid. Applications of plant tissue culture engineering, pathogen resistance (BT gene), herbicide tolerance, salt tolerance, production of secondary metabolites and transgenic plants. *(In addition to classroom teaching, practical sessions need to be incorporated)*	

PCIII-M4	**Techniques in Nanotechnology** • Nanoparticles types – Metallic, polymeric, carbon based, lipid based, semiconductor nanoparticles etc. • Synthesis of nanoparticles • Tools and techniques for characterization of nanoparticles- in vitro and in vivo characterization of nanoparticles • Principle, working, applications and data analysis of SEM, TEM, powdered X-ray, AFM, SPM, EDAX, Zeta analysis and DLS used for characterization of nanoparticles • Applications of Nanobiotechnology: Quantum dots, magnetic nanoparticles, plasmonic nanoparticles, carbon nanotubes, graphene nanoparticles and core shell nanoparticles in medicine, environment and agriculture.	**2**
PCIII-M5	**Techniques in virology** • Cultivation and purification of viruses: In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses with special emphasis on ultracentrifugation methods • Diagnostic methods: Serological and Nucleic acid-based diagnosis. Immuno-diagnosis, hemagglutinations and hemagglutination inhibition tests, Complement fixation, neutralization, Western blot, RIPA, flow-cytometry and immuno-histochemistry etc. • Microscopic techniques: Fluorescence, confocal and electron microscopic techniques • Analytical techniques: Electrophoresis, chromatography, membrane filtration, NMR, X-ray crystallography.	**2**
PCIII-M6	**Immunology and Medical Microbiology** • Epidemiological Study (designs): Case control, cohort, concurrent, cross-sectional, retrospective/prospective. • Clinical/field trials-Randomization, Bias removal (Blinding – single & double), controlled and uncontrolled trials • Immunological techniques: ELISA, RIA, immunofluorescence, RAST, RIST, MLR, flow cytometry, Magnetic sorting, MHC tetramer technology, muliplex assays, fluorescence, FACS and immunoelectron microscopy, spectra typing, surface plasmon resonance (SPR). Hybridoma technology, monoclonal antibodies and abzymes; Antibody engineering. • Animal model of immunological disease (Transgenic and knockout animals). • Generation of bone-marrow chimeras, humanized mice, parabiosis.	**2**
PCIII-M7	**Applied and Environmental Microbiology** • Recent advances in Bacterial Taxonomy -Identification of Prokaryotes, current Bergey's Manual, Computer taxonomy, 16s	**2**

	rRNA fingerprinting and lipid profile, mass spectra, API, etc • Application of biocatalysis in organic synthesis, biotransformation, enzymes in organic media, lipases and nitrilases • Advances in biofertilizers and biopesticides • Plant disease control: Antisense RNA and RNA interference technology • Generation of electricity using waste- principles and technological implications • Application of lactic acid bacteria – probiotics, criteria for selection, functional foods, Human health, and microbiome • Quorum sensing and Quorum quenching in bacteria • Bioremediation, Biostimulation, Bioaugmentation and Biosorption. • Applications of bioremediation to various contaminants & sites: Marine oil spills & Metal-contaminated soils, hyper-accumulators • Recent industrial wastewater treatment and disposal processes	
PCIII-M8	**Chromatography techniques** • Chromatography- Partition Coefficient, Selectivity, Resolution, Column Efficiency, Van Deemter equation, Interpretation of chromatograms • Principle, components of instrument, operation and application of: Gas chromatography, High Performance Liquid Chromatography, Gel filtration chromatography, Ion-exchange Chromatography and Affinity chromatography. *(In addition to classroom teaching, demonstrate the working of instruments by visiting instrumentation center/facility)*	**2**
PCIII-M9	**Genomics** • Pre and Post Genomic era, Major advancements in Genomic approaches, Epigenetics and Metagenomics, forward versus reverse Genomics, Genome Analysis- Genome editing approaches and their applications, CRISPR-Cas9 genome editing. • Gene expression approaches and their applications. Next Generation Sequencing (NGS)-Illumina (Solexa), Roche 454, Sequencing by Oligonucleotide Ligation and detection (SOLiD), Ion Torrent Technology etc. Parallel sequencing, Nanopore sequencing • Sequence analysis and their applications: Human Genetics and Human Genome Project, Genomic insights into evolution, advantages of comparative genomic analysis, Analysis of microarray data. • DNA/ Protein micro-arrays- DNA/ Protein Markers- DNA finger printing- Gene knockout - RNAi and Gene silencing- Metagenomics, application of metagenomic libraries, Metabolic engineering. • Culture independent molecular methods for identifying unculturable bacteria (PCR, FFLP, ARDRA, DGGE, TGGE,	**2**

	RAPD, Microarray, FISH, RISA), metagenomics analysis.	
PCIII-M10	**Proteomics** • Introduction, types of proteomics investigation and importance of proteomics • Tools of proteomics-Separation technology (SDS PAGE, 2D PAGE), Liquid chromatography, Mass Spectrometry (Ionizers, analyzers and detectors), Protein and peptide microarray-based technology, Protein identification by peptide mass fingerprinting. Polymerase chain reaction (PCR)-directed protein in situ arrays • Structural proteomics, Applications of proteomics: Host-pathogen interaction, protein-protein interaction, drug discovery. • Protein structure & functions prediction tools: Modeling: 2D and 3D protein modeling	**2**
PCIII-M11	**Intellectual property rights** • Intellectual Property Rights: Patentable subject matter and patent types, Trademarks, Copyrights. Purpose of a patent claim Patent claim example • Determining the scope of a patent claim, the language of a patent claim, focus on point of novelty. Introduction to Patenting of Microbiological materials and GMO, implication of patenting, current issues, patenting of genes and DNA sequences. • Deposition of microorganisms for the purposes of Patent; Biosafety issues, Ethical, legal and social issues in Scientific research. *(Visit to culture collection center, presentation on case studies and mock-patent writing need to be included)*	**2**
PCIII-M12	**Recent Trends in microbial drug resistance, pathogenicity and therapeutics** • Antimicrobial resistance: types of antimicrobial agents, mechanisms of drug resistance, global emergence and spread of multidrug resistant pathogens (ESKAPE group and *M. tuberculosis*), control strategies. • Microbial Pathogenicity: biochemical and molecular assays for screening of Virulence factors, pathogenicity islands, host pathogen interaction. • Novel antimicrobials: Alternative therapies (bacteriophage therapy, nanomedicine, antimicrobial peptides, other natural products of plant or microbial origin, screening and development approaches of novel antimicrobials (*in vitro* and *in vivo* assays, high content screening, safety assays etc.).	
PCIII-M13	**Bioprocess technology and bioengineering:** • Microbial Products: Enzymes, metabolites, biomass, recombinant products. Screening assays, production, purification, characterization • Industrially important microorganisms: Isolation methods, screening assay and strain improvement (Mutation, Genetic recombination)	

	• Applications of microbial products (Bioremediation, medical, food, agriculture, cosmetics, pharmaceutical etc); Toxicological evaluation; formulations of microbial products; • Large scale production and recovery of value-added products: Media formulation, pretreatment and optimization (by Plackett Burman design, response surface methodology, simplex design), Fermentation and Downstream processing	
PCIII-MI17	**Advances in Agriculture Microbiology:** • Soil Structure and components • Application of agriculturally important microbes (PGPR, metal chelators, nitrogen fixating microbes, Hydrogen cyanide producers and secondary metabolite producers), Developing Biofertilizers and Biocontrol strategies • Analysis of plant- microbes inteaction using advanced microscopic techniques, omics techniques -Arbuscular mycorrhizae use in agriculture • Abiotic (salt, pH, Temperature, metal) and biotic stress response (pathogens/Herbivore) in plants. • Analytical Techniques in agriculture research: Pot assay, Cell and callus culture, Anther culture, Micro-propagation, Somatic cell hybridization, Protoplast fusion, Cybrids, Artificial seeds, Agrobacterium mediated gene transfer and use of Ti plasmid, pathogen resistance (BT gene), herbicide tolerance, salt tolerance, Antisense RNA and RNA interference technology	
PCIII-M14	**Metabolomics** • Metabolome- basic overview • Preparation of experimental design; basic sample preparation-extraction and derivatization; • Analytical methods in metabolomics (introduction to mass spectrometry); Data acquisition and processing; Annotation and confirmation of metabolites; Structural elucidation of new compounds, software used for metabolomic studies. • Inclusion of metabolites into biosynthetic pathways; Using stable isotopes for pathway determination • Examples of metabolomic studies on various models (plant, food, microbes etc), on models • Integration of metabolomics with other 'omics' approaches as genomics, transcriptomics and proteomics.	**2**
PCIII-M15	**Advanced techniques in Microscopy** • Principles of image formation, Concept of point spread function and optical resolution, Confocal laser scanning microscopy, Spinning disk confocal microscopy, Multiphoton microscopy, • Advanced fluorescence microscopy techniques: FRET, FLIM, FCS, TIRF, Super-resolution microscopy: STED, Single molecule	**2**

	localization microscopy (PALM and STORM), SIM, digital image formation and image processing, Image deconvolution and quantification	
PCIII-M16	**Current Perspectives in Cancer biology** : • Origin and adaptation mechanisms of cancer cells, • Hallmarks of cancer, Tumor suppressor and Oncogenes, Tumor microenvirinment and tumor growth, Cancer stem cells, Epithelial to mesenchymal transition and metastasis, cell signaling in cancer, cancer-immune system evasion mechanisms, • Concept of cancer biomarkers and their use in cancer diagnosis and prognosis, • Emerging concepts in cancer therapy: cancer immunotherapy, hyperthermia etc.	**2**

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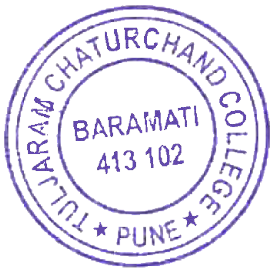


Revised Course work Structure and Syllabus of Ph.D. Statistics (Effective from 2021-22)

Structure: The course work consists of three Parts, **A, B** and **C,** totalling **18 credits** with the following details.

1. **Part A: Research Related Courses – 6 credits**
   a. STR RM : Research Methodology – 4 credits
   b. STR PE : Publication Ethics – 2 credits

2. **Part B: Subject Related Courses - 8 credits**
   a. STR MF : Mathematical Foundations for Research – 2 credits
   b. STR AP: Advanced Probability Concepts– 3 credits
   c. STR AI: Advanced Inference Concepts - 3 credits

3. **Part C: Research Related Activities - 4 credits**
   a. Prepare Proposals for Funding – 1 credit
   b. Seminar – Paper Presentation (2 National/International) - 2 credits
   c. Review of Research Papers (1 Theory + 1 Application) – 1 credit

Duration: A student is expected to complete PART A and PART B of the coursework within one year of the admission. However, under special circumstances, the Head of the Department, in consultation with the Department Research Council can extend the period for the completion of the coursework.

Equivalent Courses: The Departmental Research Council can decide the equivalent courses (from M.Sc. curriculum of Statistics/Mathematics/Computer Science/CMS/IDSSC Departments or NPTEL/SWAYAM courses with additional topics/exercises) for the courses in Parts A and B.

Evaluation: Concerned teaching faculty can opt for evaluation types such as tutorials, quizzes, seminars, assignments and tests (open/closed). However, for each course there shall be a minimum of three pieces of assessments. The final grade/percentage of marks with the details from three pieces should be submitted to the Ph.D. Course Coordinator/Head of the Department at the end of the course work.

Grades/Marks: For all the courses, the grading will be as follows:
O grade – 90 to 100 %; A grade – 75 to 89 %; B grade – 60 to 74 %; C grade – 50 to 59 %; Fail – Less than 50 %

Failed Candidates: Failed candidates will have to undergo the evaluation process again. The concerned faculty's decision would be final in this respect.

Part A: Research Related Courses

Course Code: STR RM
Course Name: Research Methodology
Credits: 4

Objectives:
The objective of the course is to introduce the meaning and scope of research. Also, this course is to expose the students to present day tools and techniques of handling problems related to statistical computations.

Learning Outcomes:
After completion of the course, students would be able to understand the meaning and scope of doing scientific research. Also, they would be able to use most of the advanced computational algorithms and tools used in modern statistical inference problems.

Detailed Syllabus:

1. **Scientific Research Methods**

Objectives and purpose of research, Philosophical foundation for knowledge creation and dissemination, Epistemological, Ontological and other issues in science research,

Qualitative and quantitative research, different methods

Role of statistics in scientific research, research design, statistical research project

Types of statistical research: empirical, field experiments, laboratory experiments, and secondary sources of data, exploratory and confirmatory research, planned and ad-hoc methods of data collection, non-response and methods of recovering the missing response

2. **Missing values and Imputations Methods:**

Missing values and types of missingness, imputations methods for missing values, single and multiple imputations. MCMC methods for missing values, EM algorithm and applications: EM algorithm for incomplete data, EM algorithm for mixture models, EM algorithm for missing values, stochastic EM algorithm.

3. **Bootstrap, Jackknife and Cross validation Methods:**

Bootstrap methods, estimation of sampling distribution, various types of confidence intervals, variance stabilizing transformation, jackknife and cross-validation, permutation tests. bagging and boosting methods with applications. cross validation

4. **Smoothing Methods:**

   Kernel estimators, nearest neighbor estimators, orthogonal and local polynomial estimators, wavelet estimators, splines, choice of bandwidth and other smoothing parameters.

5. **Optimization Methods:**

   Basic optimization problem, constraints: linear and nonlinear, local and global solutions, derivatives and gradients based methods, first and second order methods, stochastic methods genetic and particle swarm method, simulated annealing, dynamic programming

Reference Books:

1. Buuren, Stef van (2012). Flexible Imputation of Missing Data. Chapman and Hall.
2. Chihara, L. and Hesterberg, T. (2011) Mathematical Statistics with Resampling and R. Wiley.
3. Davison, A.C. and Hinkley, D.V. (1997) Bootstrap methods and their Applications. Chapman and Hall.
4. Effron, B and Hastie, T (2016). Computer-Age Statistical Inference-Algorithms, Evidence and Data Science, Cambridge University Press.
5. Engelbrecht, A. P. (2007). Computation Intelligence: An Introduction, Wiley
6. Gilks, W. R., Richardson, S., and Spiegelhalter, D. (eds.) (1995) Markov Chain Monte Carlo in Practice. Chapman and Hall.
7. Good, P. I. (2005) Resampling Methods: A Practical Guide to Data Analysis. Birkhauser Bosel.
8. Jim, A. (2009). Bayesian Computation with R, 2nd Edn, Springer.
9. Kochenderfer, M. J. and Wheeler, T. A. (2019). Algorithms for Optimization, MIT Press,
10. Kothari C.R (2014) - Research Methodology, Third Edition, Wiley Eastern Limited
11. McLachlan, G.Y. and Krishnan, T. (2008). The EM Algorithm and Extensions. Wiley.
12. Nocedal, J. and Wright, S. J. (2006), Numerical Optimization, Springer
13. Patten. M. L. and Newhart, M. (2017). Understanding Research Methods: An Overview of Essentials, 10th Ed., Routledge.

Course Code: STR PE
Course Name: Publication Ethics
Credits: 2

Objectives:

Publication is an important activity associated with any type of research. The objective of this course is to make the research student aware about the ethics associated with publication activity.

Learning Outcomes:

As an outcome of this course, the researcher is expected to follow good ethical practices in his/her future research publications.

Detailed Syllabus:

1. **Philosophy and Ethics:**
   Introduction to philosophy: definition, nature and scope, concept, branches. ethics: definition, moral philosophy, nature of moral judgements and reactions

2. **Scientific Conduct:**
   Ethics with respect to science and research, intellectual honesty and research integrity. scientific misconducts, falsification, fabrication, and plagiarism (FFP). Redundant publications: duplicate and overlapping publications, salami slicing. selective reporting and misrepresentation of data.

3. **Publication Ethics:**
   Publication ethics: definition, introduction and importance. Best practices/standard setting initiatives and guidelines: COPE, WAME, etc. conflicts of interest. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice versa, types. Violation of publication ethics, authorship and contributorship, identification of publication misconduct, complaints and appeals. predatory publishers and journals.

4. **Open Access Publishing:**
   Open access publication and initiatives. SHERPA/ROMEO online resource to check publisher copyright & self-archiving policies. Software tool to identify predatory publications developed by SPPU. Journal finder/Journal suggestion tools viz. JANE. Elsevier journal finder, Springer journal suggester, etc.

5. **Publication Misconduct.**
   5.1 Group discussions: Subject specific ethical issues, FFP, authorship, conflicts of interest, complaints and appeals: examples and fraud from India and abroad.
   5.2 Software tools: use of plagiarism software like Turnitin, Urkund and other open-source software tools.

6. **Databases and Research Metrics:**
   6.1 Databases: (i) Indexing databases (ii) Citation databases: Web of Science, Scopus, etc.
   6.2 Research Metrics: (i) Impact Factor of Journal as per Journal Citation Report, SNIP, SJER, IPP, Cite Score. (ii) h-index, g index, i10 index, altmetrics

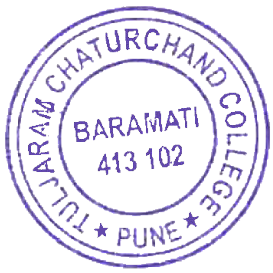
Books Recommended:

1. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489 (7415), 179.

2. Bird, A. (2006). Philosophy of Science. Routledge.
3. Chaddah, P. (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarize.
4. Maclntyre, Alasdair (1967). A Short History of Ethics. Routledge, London.
5. Muralidhar, K., Ghosh, A. and Singhvi, A. K.(2019). Ethics in Science Education, Research and Governance, Indian National Science Academy, New Delhi.
6. 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.
7. Resnik, D. B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10.

Video Resources:

1. Philosophy and Ethics: https://www.youtube.com/watch?v=ONdfTAOblJ8 ; https://www.youtube.com/watch?v=avv8x5FaSIA ; https://www.youtube.com/watch?v=K7S-Y7P3mN4
2. Scientific Conduct: https://www.youtube.com/watch?v=GA0faeZXP8w ; https://www.youtube.com/watch?v=sUEreDQpWeg&t=16s
3. Publication Ethics: https://www.youtube.com/watch?v=tFq5U-1nb8Q ; https://www.youtube.com/watch?v=URz1ewvc-xw; https://www.youtube.com/watch?v=fGgwNClHyCo ; https://www.youtube.com/watch?v=CxC6SJ5Q7FA&t=180s ; https://www.youtube.com/watch?v=e1UV1glccLU; https://www.youtube.com/watch?v=LmMDIBENHhU&t=78s; https://www.youtube.com/watch?v=S4WaifPcsl0; https://www.youtube.com/watch?v=fGgwNClHyCo&t=35s
4. Open Access Publishing: https://www.youtube.com/watch?v=CFa2QeMgk9k; https://www.youtube.com/watch?v=n1ZySivYQ3w; https://www.youtube.com/watch?v=msH-vW2tTio
5. Publication Misconduct: https://www.youtube.com/watch?v=Qcf5IZmRckY; https://www.youtube.com/watch?v=_OmEaqqI3-c; https://www.youtube.com/watch?v=goKHcO4JbGs;
6. Databases & Research Metrics: https://www.youtube.com/watch?v=cD9xVUGEzmM; https://www.youtube.com/watch?v=7HqQ7nk2Z-4; https://www.youtube.com/watch?v=WKDmC7q_scw



Part B: Subject Related Courses - 8 credits

Course Code: STR MF
Course Name: Mathematical Foundations for Research
Credits: 2

Objectives:

The objective of this course is to provide basic fundamental mathematical ideas of analysis, calculus and linear algebra needed for Statistics research.

Learning Outcomes:

Learning this course can help the student to create sharp logical arguments, clarity and correctness in statements and proofs related to the research.

Detailed Syllabus:

1. **Mathematical analysis**
   Real and complex number systems
   Basic notions of set theory
   Elements of point-set topology
   Limits and related theory
   Continuity and related theory
2. **Calculus of single and several variables**
   Calculus of single variable - Derivatives and related theory
   Calculus of several variables – Derivatives (partial, total, directional etc.) and related theory, Implicit functions and extremum problems
   Integrals and related theory - Riemann, Riemann-Stieltjes and Lebesque
   Multiple Integrals –Riemann, Lebesque, Line and Surface
3. **Linear algebra**
   Vector space and related theory, system of linear equations
   Linear Transformations
   Orthogonality, determinants, eigen value theory
   LU Factorization, Cholesky factorization, spectral decomposition, singular value decomposition
   Quadratic forms and related theory

Books Recommended

1. Apostol, T. M. (1975). Mathematical Analysis: A Modern Approach toAdvanced Calculus, Addison – Wesley

2. Ghorpade, S. R. and Limaye, B. V. (2006). A Course in Calculus and Real Analysis, Springer
3. Kreyszig, E. (1975). Advanced Engineering Mathematics, Wiley Eastern
4. Lay, D. C. Lay, S. R. and Mc Donald, J. J. (2016) .*Linear Algebra and Its Applications*, Fifth Edition, Pearson, Boston.
5. Ramachandra Rao, A. and Bhimasankaram, P. (2000). *Linear Algebra*. Hindustan Book Agency
6. Rao, C. R. (1995). *Linear Statistical Inference and Its Applications*, Wiley
7. Rudin, W. (1985). Principles of Mathematical Analysis, McGraw - Hill
8. Searle, S. R. and Khuri, A., (2017). *Matrix Algebra Useful for Statistics*, 2nd Edn., John Wiley, NewYork

Course Code: STR AP
Course name: Advanced Probability Concepts
Credits: 3

Objectives:

The objective of this course is to provide theoretical foundations of probability theory which are needed in statistics research.

Learning Outcomes:

After completion of the course, students would be able to (i) apply probability concepts in Statistics courses and (ii) apply probability and related concepts in theoretical development of research ideas wherever necessary.

Detailed Syllabus:

1. **Measure and Integration**

   Measures, Lebesgue-Stieltjes measures, Caratheodory extension theorem, Completeness of measures, Measurable transformations, Induced measures, distribution functions, Integration, Riemann and Lebesgue integrals

   The Lebesgue-Radon-Nikodym theorem, Signed measures, Functions of bounded variation, Absolutely continuous functions on R, Singular distributions, Jordan Decomposition of a cdf, Introduction to Product spaces and product measures, Convolutions

2. **Probability Spaces**

   Random variables, random vectors, random processes, Kolmogorov's consistency theorem

3. **Convergence and Laws of Large Numbers**

Review of different modes of convergence and their implications, Weak convergence, Skorohod's theorem and the continuous mapping theorem. Concept of tightness

Weak laws of large numbers, strong laws of large numbers (Kolmogorov's), Introduction to ergodic theorem

4. **Generating Functions**
   Generating functions, Laplace and Fourier transforms, Definition and examples, Characteristic functions, Inversion formulas, Levy-Cramer continuity theorem

5. **Central Limit Theorems**
   Lindeberg-Feller theorems, Stable distributions, infinitely divisible distributions, CLT for stationary ergodic sequences, Empirical process and Brownian bridge

6. **Martingales**
   Conditional Expectation and probability, Discrete Parameter Martingales, Martingale convergence theorems, SLLN, Central limit theorem, mixing sequences

Books Recommended:

1. Athreya, K. B. and Lahiri, S. N. (2006). *Measure Theory and Probability Theory*. Springer.
2. Billingsley, P. (1995), *Probability and Measure*, 3rd edn, John Wiley.
3. Chung, K. L. (2001). *A Course in Probability Theory*, Academic Press.
4. Klenke, A. (2014). *Probability Theory: A Comprehensive Course*. Springer.
5. Leadbetter, R., Cambanis, S. and Pipiras, V. (2014). *A Basic Course in Measure and Probability Theory for Applications*. CUP
6. Robert B. Ash (2000). *Probability & Measure Theory*, Academic Press
7. Royden, H. L. (1988), *Real Analysis*, 3rd edn, Macmillan.
8. Williams, D. (2004). *Probability with Martingales*, CUP.

Course Code: STR AI
Course Name: Advanced Inference Concepts
Credits: 3

Objectives:
The objective of this course is to provide theoretical foundations of statistical inference.

Learning Outcomes:
After completion of the course, students would be able to develop the inferential tools for their research and establish/investigate the properties of the suggested estimators and testing procedures.

Detailed Syllabus:

1. **Principles of Inference**
   Algorithms and inference, frequentist inference, frequentism in practice, frequentist Optimality, flaws in frequentist inference, Bayesian/frequentist comparison

   Likelihood principle, sufficiency principle, conditionality principle, implications

2. **Estimation Theory**
   A review of UMVU estimation, A review of CAN estimation theory.

   Maximum likelihood estimates, inconsistent MLEs , MLEs in the exponential family, more general cases and asymptotic normality, observed and expected Fisher information, asymptotic optimality of the MLE and super efficiency, loss of information and Efron's curvature.

3. **Asymptotic Theory in Testing of Hypothesis**
   Likelihood ratio tests and asymptotic theory of likelihood ratio test statistics, distribution under alternatives, asymptotic efficiency in testing, asymptotic distribution of Pearson's chi-square, asymptotic distribution under alternatives and consistency

4. **Large-Scale Hypothesis Testing and FDRs**
   Chi-square tests with many cells and sparse multinomials, regression models with many parameters: Multiple testing and false discovery definitions, Benjamini-Hochberg rule, distribution theory for false discoveries and Poisson and first-passage asymptotics, lower bounds on the number of false hypotheses, newer FDR

5. **Bayesian Methods**
   Fundamental elements, general form of Bayes rules, minimax, Bernstein-vonMises theorem, shrinkage and the James–Stein estimator, ridge regression, empirical Bayes, choice of prior distributions, hierarchical modeling, predictive distributions, posterior Consistency, introduction to nonparametric Bayesian methods

6. **Causality and Causal Inference**
   Introduction to causality and causal inference, theory of inferred causation, identification of causal effects, examples of causality and structural models in various disciplines

Books Recommended:

1. Anirban Das Gupta (2008). *Asymptotic Theory of Statistics and Probability*. Springer
2. Deshpande, J. V., Naik-Nimbalkar, U. N., Dewan, I. (2018). *Nonparametric Statistics: Theory and Methods*. Worl-Scientific.
3. Efron, B., Hastie, T. (2016). *Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*, CUP.
4. Fergusson, T. S. (1968). *Mathematical Statistics: A Decision Theoretic Approach*, Academic Press.
5. Lehmann, E. L. and Casella, G. (1998). *Theory of Point Estimation*, Springer.
6. Lehmann, E. L. and Romano, J. P. (2005). *Testing Statistical Hypothesis*, Springer
7. Pearl, J. (2009). *Causality: Models, Reasoning and Inference*.CUP
8. Young, G. A. and Smith, R. L. (2005). *Essentials of Statistical Inference*, CUP.

Savitribai Phule Pune University

Faculty of Commerce and Management : All BOS in Management

Syllabus for PhD Course Work[1] Part I, II & III

Part	Title	Credits	Duration	Assessment
1	**Research Methodology - (**Including Quantitative methods, Computer applications, research ethics and review of published research in the relevant field, training, field work, etc**) - Syllabus as defined by SPPU (2019)[2]**	**04**	**60 hours**	50% Assessment in the form of 2 home assignments, 25% Assessment in the form of Presentation on Research Design and 25% Assessment in the form of MCQs on entire syllabus (Total : 100 Marks)
2 - A	Writing of **Research Proposal** for **obtaining Financial assistance** from national funding agencies	**01**	**15 hours**	Drafted Proposal to be submitted to an identified funding agency, under the guidance of the Research Advisory Committee.
2 - B	**Writing of Review**	**01**	**15 hours**	1 (ONE) Research Paper based on Review of Literature to be Published in UGC CARE / SCOPUS JOURNAL (Research Scholar as the first author and Research Guide as the second author)
2 - C	**Seminars**	**02**	**30 hours**	2 (TWO) Research Papers to be presented at National / International Seminars (Research Scholar as the first author and Research Guide as the second author)
3	**Subject specific advanced level courses** (Total 8 Credits)			

[1] Ref: SPPU CIRCULAR NO. 14/ 2OI7 dated 9/1/2017

[2] http://collegecirculars.unipune.ac.in/sites/documents/MPhilPhD%20Syllabus2019/Comm%20and%20Managt%20M%20Phil%20and%20PhD%20Course%20work%202019_04.0322019.pdf

3 - A	**MOOCs** related to the PhD Topic/ Discipline as Suggested by the Research Advisory Committee[3]	**01**[4]	**30 hours**	Certificate of MOOCs completion to be submitted
3 - B	**Course Work on Analytical Tools (SPPS / Qualitative Analysis)**	**03**	**45 hours**	Assessment covering various analytical tools through analysis of live data (50 Marks)
3 - C	**Pilot Study**	**02**	**30 hours**	1 (ONE) Research Paper to be presented at National / International Seminars OR Published in UGC CARE / SCOPUS JOURNAL (Research Scholar as the first author and Research Guide as the second author)
3 - D	Online / In Classroom Course on **Research & Publication Ethics (RPE 01 to RPE 06) - Syllabus as defined by UGC**[5]	**02**	**30 hours**	MCQ based test of 50 Marks to be conducted by the Research Centre.

Link for Detailed syllabus of PhD Course Work – Part I:
http://collegecirculars.unipune.ac.in/sites/documents/MPhilPhD%20Syllabus2019/Comm%20and%20Managt%20M%20Phil%20and%20PhD%20Course%20work%202019_04.0322019.pdf

[3] MOOCs from SWAYAM Platform shall be preferred. MOOCs from other platforms are also permitted.
[4] MOOC of 4 weeks duration shall be equivalent to 1 Credit
[5] https://www.ugc.ac.in/pdfnews/9836633_Research-and-Publication-Ethics.pdf

सावित्रीबाई फुले पुणे विद्यापीठ, पुणे

विद्यावाचस्पती : पाठ्यक्रम-कार्याभ्यास

(Ph.D. Course Work Syllabus)

मराठी विषयाचा पुनर्रचित अभ्यासक्रम

(जून २०२४ पासून)

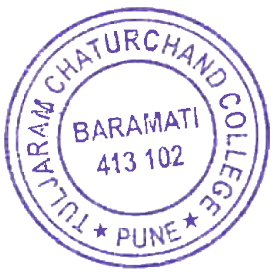
अभ्यासपत्रिकांची नावे

क्रमांक	अभ्यासपत्रिकेचे नाव	अध्यापन तासिका	अध्ययनाच्या तासिका	श्रेयांक (Credit)	गुण
१	संशोधन : स्वरूप आणि पद्धती	३६	२४	४	१००
२	संशोधनपर उपक्रम	३६	२४	४	१००
३	अ) मराठी भाषा आणि साहित्य : विविध अभ्यासक्षेत्रे	३६	२४	४	१००
	ब) अभ्यास कार्य	३६	२४	४	१००

परीक्षा व प्रश्नपत्रिका स्वरूप

वेळ ३ तास :	परीक्षा	गुण :१००
अभ्यासपत्रिका १, २, ३ (अ) साठी प्रश्नपत्रिका स्वरूप		
१	बहुपर्यायी प्रश्न : बारा पैकी दहा प्रश्न सोडविणे.	२०
२	लघुत्तरी प्रश्न : चार पैकी दोन प्रश्न सोडविणे.	३०
३	दीर्घोत्तरी प्रश्न : चार पैकी दोन प्रश्न सोडविणे.	५०
	एकूण	**१००**
अंतर्गत मूल्यमापन		
३ (ब) अभ्यास कार्य		
१	संशोधनविषयाशी निगडित दोन दीर्घ शोधनिबंधांचे लेखन *	४०
२	प्रबंध परीक्षण लेखन *	१०
३	पुस्तक परीक्षण लेखन *	१०
४	क्षेत्रभेट अहवाललेखन *	१०
५	संशोधनविषयाचे सादरीकरण व मौखिकी	२०
६	संशोधन प्रस्ताव लेखन	१०
	एकूण	**१००**
अंतर्गत मूल्यमापनासाठी वरील सर्व पर्याय आवश्यक आहेत.		

* अंतर्गत मूल्यमापनातील घटक क्र.१ ते ४ याचे मूल्यमापन विद्यार्थ्यांच्या मार्गदर्शकाने करावयाचे आहे.



- **पीएच. डी. पाठ्यक्रम-कार्याभ्यास (Ph.D. Course Work Syllabus): मार्गदर्शक तत्त्वे**

१ मान्यताप्राप्त संशोधन केंद्रांनी स्वतंत्र किंवा एकत्रितपणे, सा.फु.पु.विद्यापीठाच्या नियमांच्या अधीन राहून पाठ्यक्रम-कार्याभ्यासाचे आयोजन करावे व अभ्यासमंडळास तसे अवगत करावे.

२ पीएच.डी.पाठ्यक्रम-कार्याभ्यास (Ph.D. Course Work) हा एका सत्रामध्ये अधिकतम सहा महिन्यांमध्ये घ्यावयाचा आहे.

३ पीएच.डी.पाठ्यक्रम-कार्याभ्यासामध्ये अध्यापनासाठी १०८ तासिका (तीन आठवडे) असतील.

४ परीक्षा आणि अंतर्गत मूल्यमापनासाठी ३६ तासिका असतील.

५ उर्वरित तासिका अध्ययन-तासिका अभ्यासकार्यासाठी असतील.

६ पाठ्यक्रम-कार्याभ्यासामधील अध्ययनप्रणालीचा कालावधी सहा महिन्यांचा असेल. त्यामध्ये अध्यापनकार्य कालावधी २१ दिवसांचा (रोज किमान ६ तास); उर्वरित काळात अभ्यासकार्य, स्वयंअध्ययन आणि अंतर्गत मूल्यमापन, परीक्षा असेल.

७ संशोधक विद्यार्थ्याने स्वत:चे अभ्यासकार्य आणि स्वयंअध्ययन हे 'संशोधन केंद्रसमन्वयक' व आपल्या 'मार्गदर्शकांच्या' मार्गदर्शनात निर्धारित वेळेत पूर्ण करावयाचे आहे.

८ संशोधकाचे पाठ्यक्रम-कार्याभ्यासातील अध्यापनकार्य संपल्यानंतर साडेतीन महिन्यात सर्व प्रकारचे अभ्यासकार्य हे (युनिकोड फॉन्टसाईज १६, पाठपोट टंकलिखित) सर्पिल बांधणी (Spiral Binding) या प्रकारात मार्गदर्शकांकडे जमा करणे अनिवार्य असेल.

९ मार्गदर्शकांनी प्राप्त अभ्यासकार्य (शोधनिबंध) तपासून व गुणांकन करून पुढील एक महिन्याच्या आत केंद्रसमन्वकांकडे जमा करावे.

१० अंतिम महिन्यात केंद्र समन्वयकांनी परीक्षेचे गुण व अभ्यासकार्य गुण एकत्रित करून अंतिम गुणपत्रक तयार करून पाठ्यक्रम-कार्याभ्यासाचे प्रमाणपत्र (Course Work Certificate) तयार करून वितरित करावे.

अभ्यासक्रमाची उद्दिष्टे :

१ संशोधन संकल्पना, स्वरूप, आवश्यकता आणि मराठीतील संशोधनप्रक्रियेचा परिचय करून देणे.

२ संशोधनविषयक तात्त्विक मीमांसेचा परिचय करून देणे.

३ विविध संशोधनपद्धतींचा व साहित्य संशोधनपद्धतींचा परिचय करून देणे.

४ साहित्य आणि विविधज्ञानशाखा यांच्या सहसंबंधांचा, साम्यभेदांचा परिचय करून देणे.

५ संशोधनासाठी अर्थसाहाय्य करणाऱ्या संस्थांचा परिचय करून देणे.

६ मराठी साहित्यातील विविध क्षेत्रे आणि संशोधनविषयक संधींचा परिचय करून देणे.

७ साहित्य संशोधनासाठी आवश्यक तंत्र आणि कौशल्यांचा परिचय करून देणे.

८ प्रबंधलेखनरीतीचा व लेखनसंकेतांचा परिचय करून देणे.

९ पीएच.डी.पदवी प्रक्रियेतील कार्यप्रणालीचा परिचय करून देणे.

१० साहित्य संशोधन आणि जीवनमूल्ये यांच्या परस्पर प्रभावाचा परिचय करून देणे.

११ संशोधनव्यवहारातील नीतिशास्त्राची ओळख आणि त्याचे संशोधनव्यवहारातील महत्त्व स्पष्ट करणे.

१२ ग्रंथ आणि शोधप्रबंध मूल्यमापनविषयक कौशल्यविकास करणे.

१३ संशोधनासाठी आवश्यक संगणकीय कौशल्ये आणि आंतरजालावरील संदर्भसाधनांचा शोध या संदर्भातील कौशल्ये विकसित करणे.

१४ विद्यापीठाच्या online प्रवेश प्रक्रिया व एकूणच Ph.D. Tracking बाबत विद्यार्थ्यांना अवगत करणे.

अभ्यासपत्रिका क्र.१

संशोधन : स्वरूप आणि पद्धती

गुण : १०० श्रेयांक : ४ (अध्यापन तास ३६)

१ संशोधन : स्वरूप, संकल्पना आणि पद्धती

१.१ संशोधनस्वरूप आणि संकल्पना, प्रेरणा, आवश्यकता आणि फलित, संशोधकाचे गुणविशेष आणि पाळावयाची पथ्ये, विज्ञान, सामाजिकशास्त्रे, साहित्य संशोधन यातील साम्य-भेद.

१.२ संशोधन पद्धती : विगनात्मक, निगमनात्मक, प्रयोगनिष्ठ, वर्णनात्मक, ऐतिहासिक, तौलनिक, क्षेत्रीय पाहणी, भाषा सर्वेक्षण, नमुना पाहणी पद्धती, समाकलन, विमर्शक, शास्त्रीय इ.

१.३ संशोधन आणि पद्धतीशास्त्र

१.४ संशोधन आणि अर्थनिर्णयनशास्त्र

२ संशोधनाची साधने आणि तंत्र :

२.१ संशोधन ग्रंथालये : वैशिष्ट्ये, सेवा आणि गरजा

२.२ अभिलेखागारे : स्वरूप, महत्त्व, कागदपत्रे जतन करण्याच्या पद्धती, महाराष्ट्र व भारतातील अभिलेखागारे

२.३ ग्रंथालयीन संदर्भसाहाय्य, मूलस्रोतांचा शोध, साधनांची प्रतवारी, आवृत्तीची ग्रह्याग्राह्यता

२.४ सूचीशास्त्र व त्याचे उपयोग

३ संशोधन प्रक्रिया

३.१ संशोधन विषयाची निवड, वाचनाचे संयोजन, संदर्भ शोध (ग्रंथालय, आंतरजाल)

३.२ संशोधनपर लेखन : संशोधन प्रस्ताव तयार करणे.

३.३ संशोधन विषयक पूर्वसंशोधनाचा मागोवा व नावीन्य शोध (ग्रंथालय, शोधगंगावरील पीएच.डी. प्रबंधांचे परीनिरीक्षण)

३.४ ग्रंथमूल्यमापन, शोधप्रबंध परीनिरीक्षण, संशोधनपर लेखनपद्धती....

३.५ संशोधनाची मांडणी (मुखपृष्ठ, विषयानुक्रमाणिका, प्रास्ताविक, उद्दिष्टे, गृहीतके, प्रकरण मांडणी, प्रकरण आणि प्रबंध रचना, उपसंहार, निरीक्षणे व निष्कर्ष नोंद : तंत्र आणि पद्धती, संदर्भप्रक्रिया, संदर्भक्रम, परिशिष्टे, संदर्भ सूची, निर्देश सूची इ.)

३.६ प्रबंधलेखनाची भाषाशैली, संशोधनलेखनपद्धती, लेखनसंकेत.

३.७ विद्यापीठीय नियम (प्रगती अहवाल लेखन व सादरीकरण, प्रबंध अहवाल लेखन, प्रबंधाची सारांशपत्रिका, प्रबंध सारांश पत्रिकेचे सादरीकरण, अंतिम तोंडी परीक्षा [Viva – voce])

४ संगणकाचा वापर : संगणकीय शोध, विविध संकेतस्थळे (ग्रंथालय, शोध नियतकालिके इ.), MS-Word, Excel, Power point, PDF, e mail इ. चा वापर, विविध ॲप्स (गुगल स्कॉलर, भाषांतर आदी) , युनिकोडचा वापर, संगणकीय अक्षरजुळणी, मुद्रितशोधन, आंतरजाल, Shodhganga, Swayam आदींचा वापर.

२. अभ्यासपत्रिका

संशोधनपर उपक्रम

गुण : १०० श्रेयांक : ४ (अध्यापन तास ३६)

१ संशोधनपर उपक्रम :

१.१ शोधप्रकल्प लेखन

लघुशोधप्रकल्प, बृहद शोधप्रकल्प (प्रकल्प आराखडा, लेखन, सादरीकरण इ.)

१.२ कार्यशाळा, चर्चासत्र (शोधनिबंध लेखन आणि सादरीकरण)

१.३ संशोधनविषयाचे सादरीकरण व मौखिकी

१.४ पाठ्य / शोधवृत्ती

१.५ क्षेत्रभेट (मुलाखत, क्षेत्रीय पाहणी, प्रश्नावली, संख्याशास्त्रीय आढावे)

१.६ संशोधनपर नियतकालिकांतील लेखन...

२ संशोधन आणि ग्रंथालये

ग्रंथालयांचा परिचय, प्रकार, त्यांची नावे, कामकाज.

३ संशोधनपूरक आंतरजालावरील सुविधा

भाषांतर, संदर्भ ग्रंथ इ.

४ संशोधनासाठी अर्थसाहाय्य करणाऱ्या संस्थांचा परिचय

शासकीय, निमशासकीय आणि खासगी संस्था.

अभ्यासपत्रिका क्र.३

अ) मराठी भाषा आणि साहित्य : विविध अभ्यासक्षेत्रे

गुण : १०० श्रेयांक : ४ (अध्यापन तास ३६)

१ मराठी भाषा आणि साहित्य संशोधनाची वाटचाल

१.१ मराठीतील संशोधनाचा आढावा

१.२ मराठीतील संशोधकांचा परिचय....

२ साहित्य आणि इतर सामाजिक शास्त्रे : अनुबंधात्मक अभ्यास

२.१ साहित्य आणि तत्त्वज्ञान

२.२ साहित्य आणि समाजशास्त्र

२.३ साहित्य आणि मानसशास्त्र

२.४ साहित्य आणि अर्थशास्त्र

२.५ साहित्य आणि इतिहास

२.६ साहित्य आणि विज्ञान

३ मध्ययुगीन मराठी वाङ्मयाचे संशोधन

३.१ वाङ्मयप्रकारनिष्ठ संशोधन

३.२ संप्रदायनिष्ठ संशोधन

३.३ संहिता संपादन आणि पाठचिकित्सा

३.४ ऐतिहासिक कागदपत्रे : संशोधन आणि संपादन

३.५ मध्ययुगीन वाङ्मयाचा भाषिक, सांस्कृतिक अभ्यास

४ अर्वाचीन मराठी साहित्याचे संशोधन

४.१ कालखंडाचा अभ्यास

४.२ लेखकाचा अभ्यास

४.३ साहित्यकृतीचे संशोधन

४.४ साहित्यप्रकारनिष्ठ संशोधन

४.५ समीक्षेचे स्वरूप व वाटचाल (सैद्धांतिक, उपयोजित, आस्वादात्मक)

५ भाषावैज्ञानिक संशोधन

५.१ भाषाविज्ञान : स्वरूप व पद्धती

५.२ भाषा आणि समाजभाषाविज्ञान

५.३ भाषा आणि मनोविज्ञान

५.४ भाषा आणि साहित्यसमीक्षा

५.५ शैलीनिष्ठ अभ्यास

६ बोली भाषाविषयक संशोधन

६.१ बोलीशास्त्र

६.२ बोलींच्या अभ्यासाचे प्रकार

६.३ भाषारूपांच्या संकलनातील विधीनिषेध, निष्कर्णाच्या पद्धती आणि तंत्रे

६.४ मराठी बोलींचे संशोधन

७ साहित्याचा सामाजिक-सांस्कृतिक अभ्यास

७.१ साहित्य आणि समाज : सहसंबंध

७.२ साहित्याच्या सामाजिक-सांस्कृतिक अभ्यासाचे स्वरूप व महत्त्व

७.३ भाषांतरित / अनुवादित साहित्याचा अभ्यास

७.४ लोकसाहित्याचा अभ्यास

ब) अभ्यास कार्य

गुण : १०० श्रेयांक : ४ (अध्यापन तास ३६)

अभ्यासपत्रिका १, २ आणि ३ (अ) यांची लेखी परीक्षा आणि ३ (ब) अंतर्गत मूल्यमापन

संदर्भ ग्रंथ

मराठी संदर्भ ग्रंथ

१ आधुनिक समीक्षा-सिद्धांत - मिलिंद मालशे / अशोक जोशी, मौज प्रकाशन, मुंबई- २००७.

२ आधुनिकता आणि परंपरा-एकोणिसाव्या शतकातील महाराष्ट्र- राजेंद्र व्होरा (संपा.),प्रतिमा प्रकाशन, पुणे- २०००.

३ इतिहासलेखन मीमांसा - समाजप्रबोधन पत्रिका (संपा.) लोकवाङ्मयगृह प्रकाशन, मुंबई- २०१०.

४ कादंबरी एक साहित्यप्रकार - हरिश्चंद्र थोरात, शब्द पब्लिकेशन, मुंबई- २०१०.

५ कोश वाङ्मय : विचार आणि व्यवहार - डॉ.सदाशिव देव, सुपर्ण प्रकाशन, पुणे- २००२.

६ खडक आणि पाणी- गंगाधर गाडगीळ उत्कर्ष प्रकाशन, पुणे. डिसेंबर१९६०, तृतीयावृत्ती १९८५.

७ गुणात्मक संशोधनाची कार्यपद्धती - हेस -बिबर शार्लीन नॅगी, सेज प्रकाशन, न्यू दिल्ली-२०१७.

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१ तत्त्वज्ञान व तर्कशास्त्र परिभाषा कोश

२ कार्यदर्शिका

३ साहित्य समीक्षा परिभाषा कोश

४ ग्रंथालयशास्त्र परिभाषा कोश

५ कृषिशास्त्र पारिभाषिक शब्दावली

६ न्यायवैद्यक व विषशास्त्र परिभाषा कोश

७ पदनाम कोश

८ लोकप्रशासन परिभाषा कोश

९ शिक्षणशास्त्र परिभाषा कोश

१० गणितशास्त्र परिभाषा कोश

११ वित्तीय शब्दावली

१२ राज्यशास्त्र परिभाषा कोश

१३ संख्या शास्त्र परिभाषा कोश

१४ वृत्तपत्र विद्या परिभाषा कोश

१५ भाषाविज्ञान व वाङ्मयविद्या परिभाषा कोश

१६ औषधशास्त्र परिभाषा कोश

१७ व्यवसाय व्यवस्थापन परिभाषा कोश

१८ धातुशास्त्र परिभाषा कोश

१९ यंत्र अभियांत्रिकी परिभाषा कोश

२० कृषीशास्त्र परिभाषा कोश

२१ विद्युत अभियांत्रिकी परिभाषा कोश

२२ भूगोलशास्त्र परिभाषा कोश

२३ भूशास्त्र परिभाषा कोश

२४ प्रशासन वाक्प्रयोग

२५ मानसशास्त्र परिभाषा कोश

२६ अर्थशास्त्र परिभाषा कोश

२७ विकृतिशास्त्र पारिभाषिक शब्दावली

२८ वाणिज्यशास्त्र परिभाषा कोश

२९ शरीरक्रियाशास्त्र परिभाषा कोश

३० रसायनशास्त्र परिभाषा कोश

३१ शारीर परिभाषा कोश

३२ स्थापत्य अभियांत्रिकी परिभाषा कोश

३३ न्याय व्यवहार कोश

३४ भौतिकशास्त्र परिभाषा कोश

३५ मराठी विश्वकोश

३६ भौतिकशास्त्र पारिभाषिक शब्दावली

३७ शासन व्यवहार शब्दावली

३८ जीवशास्त्र परिभाषा कोश

३९ शासनव्यवहार कोश

- **अत्याधुनिक तंत्रज्ञानाचा वापर करून सादर केलेली शब्दकोशनिहाय 'वर्णानुक्रमिक अनुक्रमणिका' पाहा!**

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Savitribai Phule Pune University, Pune

Coursework for Ph. D in English

(w. e. f. June 2024-25)

PREAMBLE

As per the Ph. D Rules, the candidates selected for admission to the Ph. D Programme in English will have to complete the coursework for a period of one semester. The coursework will carry 16 credits as follows:

Coursework

1. Course 1: Research Methodology	**04 Credits**
2. Course 2: Attending at least One Seminar/Conference/ Workshop (National/International)	**01 Credit**
3. Course 3: Subject Specific Advanced Course (Literature)	**04 Credits**
4. Course 4: Subject Specific Advanced Course (Language)	**04 Credits**
5. Course 5: Research and Publication Ethics	**02 Credits**
6. Course 6: Topic Related Seminars, Field Work, etc.	**01 Credit**

SYLLABUS

Course 1: Research Methodology

Aims and Objectives

1. To acquaint students with research methodology and research methods
2. To acquaint students with planning and execution of researchprocess
3. To prepare them to undertake research
4. To train them to present their research systematically

Contents

Unit-1 Concept of Research:

(Research methodology, research methods, types of research, research for sustainable development etc.)

Unit-2 Key Terms in Research:

(Research area and research topic, bibliography, sampling, literature review, research gap, research problem, hypothesis and hypothesis testing, types of data, data collection, primary sources and secondary sources, data analysis, investigation, exploration, case study, methods and techniques,results and findings, etc.)

Unit-3 Research in English Studies:

(Research areas and subareas in language, literature, criticism, ELLT and other domains of English studies, choice and application of appropriate theories and approaches, relevance and significance of research etc.)

Unit-4 Interdisciplinary Research:

(Concept of interdisciplinary research, choice of disciplines, relevance of study, choice and application of appropriate theories, approaches, principles and methods etc.)

Unit-5 Research Process:

(Preliminary reading, perception and observations to shortlist research areas and

subareas, survey of relevant literature, selection of a research topic,defining aim/sand objectives, formulation of research problem and hypothesis, deciding scope and limitations, choice of research method, tools and techniques, preparing a research proposal,planning and execution of research process etc.)

Unit-6 Presentation of Research:

(Format of the thesis,introductions andconclusions, footnotes and endnotes, avoiding plagiarism, quoting and creating in-textcitations, presenting research findings, using standard style sheets, use of impersonal, objective, cohesive, coherent and overall logical language in thesis writing etc.)

Unit-7 Computer Applications in Research:

(Creating and editing texts, creating and managing files and folders, sending and receiving emails, using Microsoft excel, creating and editing presentations using Microsoft Power Point,searching relevant websites and using web search engines, using e-books and journals, using various tools and techniques for data analysis etc.)

Unit-8 Research Ethics:

(Concept of research ethics, types of plagiarism, avoiding plagiarism, plagiarism checking, similarity reports, research ethics and qualitiesof a good researcher etc.)

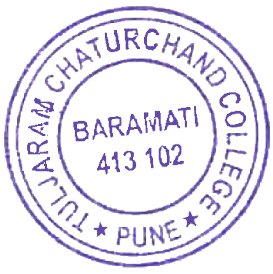
Evaluation

Internal Assessment:

Paper Pattern

Max. Marks: 30

1. Assignment : 10Marks
2. Objective Test : 20 Marks



Final Assessment:

Paper Pattern

Time: 3 Hours

Max. Marks: 70

Q. 1 Attempt any two of the following (Unit-1&2).	:15 Marks
Q.2 Attempt any two of the Following (Unit-3&4).	:15 Marks
Q.3 Attempt any two of the following (Unit-5&6).	:15 Marks
Q. 4 Attempt any two of the following (Unit-7&8).	:15 Marks
Q. 5 Write short answers on any five of the following (Unit-1 to 8).	:10 Marks

Note

Marks and Credit Ratio:

The total of 100 marks will finally be converted into 04 credits at the ratio of 25 marks for one credit. (In case of the fractional score of marks, the calculation of every credit shall be done as follows. The marks in the ratio of 0 to 12.5 value will be treated as 'zero' credit and the marks in the ratio of 13 to 25 value will be treated as 'one' credit.)

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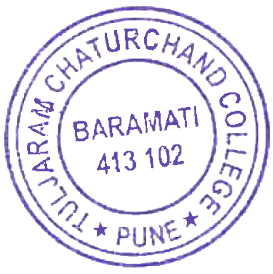
Course 2: Attending at least One Seminar/Conference/Workshop (National/International)

Total Credits: 1 **Marks: 25**

The research scholar has to attend one national or international seminar or conference or workshop related to his/her topic or subject to earn one credit under this course. The institutes must verify the documents or proofs of attendance before awarding credits to the scholars.

Documents for Verification

- Attendance certificate OR Letter of attendance issued by the organizers



Course 3: Subject Specific Advanced Course (Literature)

Total Credits: 4 **Marks: 100**

Objectives

1. To acquaint the students with the latest approaches to literature
2. To enable them to apply these approaches to literary pieces
3. To inculcate the habit of doing background reading with the help of various conventional and technological sources

Contents

Unit-1 Approaches to Literature:

The teacher/s will thoroughly discuss the approaches pertaining to the following areas.

a: Formalism and Structuralism
b. Post-Structuralism-
c. Deconstruction
d. Feminism
e. Postcolonialism
f. Cultural Studies
g. Eco-criticism and Environmental Humanities
h. Queer Theory
i. Digital Humanities
j. Overview of Indian Literary Theory

Unit-2 Application of Approaches:

Each student will be required to apply at least one approach to a literary piece like short story, poem, one-act play, novel and play or to the English language used in literature, journalism and other media, the internet, day-to-day conversations, etc. The concerned teacher/s will demonstrate how to apply these approaches.

Unit-3 Potential Research Areas in English Literature:

On the basis of Unit-1 and Unit-2, the teacher/s will discuss the potential research areas and various possibilities of research in literature. Also,the possibilities of interdisciplinary and multidisciplinary research will be discussed in this unit.

Unit-4 Survey of Relevant Literature:

Each student will be required to make a survey of literature related to an area of his/her interest under the guidance of the concerned teacher/s. This will include the use of various sources like libraries, websites and search engines.

Evaluation

Internal Assessment:

Course 3: Subject Specific Advanced Course (Literature)

Total Marks: 30

Assignment (on Unit 2)	: 10 Marks
Objective Test	: 20 Marks

Final Examination:

Course 3: Subject Specific Advanced Course (Literature)

Total Marks: 70

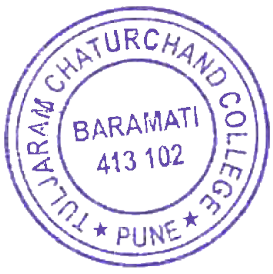
Time: 3 Hours **Max. Marks 70**

Q.1 Answer **any two** of the followingquestions on Unit One.	20 Marks
Q.2 Answer **any two** of the following questions on Unit Two**.**	20 Marks
Q.3 Answer **any two** of the following questions on Unit Three**.**	20 Marks
Q.4 Answer **any two** of the following questions on Unit Four**.**	10 Marks

Note

Marks and Credit Ratio:

The total of 100 marks will finally be converted into 04 credits at the ratio of 25 marks for one credit. (In case of the fractional score of marks, the calculation of every credit shall be done as follows. The marks in the ratio of 0 to 12.5 value will be treated as 'zero' credit and the marks in the ratio of 13 to 25 value will be treated as 'one' credit.)



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Course 4: Subject Specific Advanced Course (Language)

Total Credits: 4 **Marks: 100**

Objectives

1. To acquaint the students with the latest approaches to language
2. To enable them to apply these approaches to language and language teaching
3. To inculcate the habit of doing background reading with the help of various conventional and technological sources

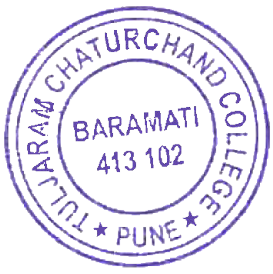
Contents

1. **Unit-1Approaches to Language and ELLT:**
   The teacher/s will thoroughly discuss the theories and the approaches pertaining to the following areas.

   Phonology
   Phonetics
   Morphology
   Syntax
   Semantics
   Pragmatics
   Discourse Analysis
   ELLT
   Historical Linguistics
   Sociolinguistics
   Psycholinguistics
   Computational linguistics
   Literary Linguistics
   Conversation Analysis
   Dialectology
   Language Acquisition

Unit-2 Application of Approaches:

Each student will be required to apply at least one approach to use of English language in literature, journalism and other media, day-to-day conversations etc. or apply any one of the approaches to language teaching. The concerned teacher/s will demonstrate how to apply these approaches.



Unit-3 Potential Research Areas in English Language:

On the basis of Unit-1 and Unit-2, the teacher/s will discuss the potential research areas and various possibilities of research in language. Also,the possibilities of interdisciplinary and multidisciplinary research will be discussed in this unit.

Unit-4 Survey of Relevant Literature:

Each student will be required to make a survey of literature related to an area of his/her interest under the guidance of the concerned teacher/s. This will include the use of various sources like libraries, websites and search engines.

Evaluation

Internal Assessment:

Course 4: Subject Specific Advanced Course (Language)

Total Marks: 30

Assignment (on Unit 2)	: 10 Marks
Objective Test	: 20 Marks

Final Examination:

Course 4: Subject Specific Advanced Course (Language)

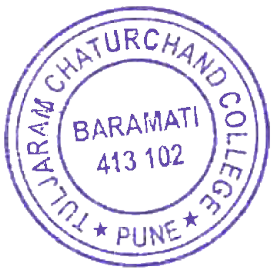
Total Marks: 70

Time: 3 Hours	**Max. Marks 70**
Q.1 Answer **any two** of the followingquestions on Unit One.	20 Marks
Q.2 Answer **any two** of the following questions on UnitTwo**.**	20 Marks
Q.3 Answer **any two** of the following questions on UnitThree**.**	20 Marks
Q.4 Answer **any two** of the following questions on UnitFour**.**	10 Marks

Note

Marks and Credit Ratio:

The total of 100 marks will finally be converted into 04 credits at the ratio of 25 marks for one credit. (In case of the fractional score of marks, the calculation of every credit shall be done as follows. The marks in the ratio of 0 to 12.5 value will be treated as 'zero' credit and the marks in the ratio of 13 to 25 value will be treated as 'one' credit.)



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Course 5: Research and Publication Ethics

Total Credits: 2 **Marks: 50**

Objectives:

- To gain insight into the ethical considerations involved in research and publication.
- To foster a strong sense of research integrity among scholars.
- To recognize and address research misconduct and identify predatory publications.
- To become familiar with indexing and citation databases, open access publications, and research metrics such as citations, h-index, and impact factor.
- To understand the use of plagiarism detection tools.

Contents

Unit I: Introduction to Research Ethics and Integrity **5 hrs**

- Definition and importance of research ethics
- Historical context and key milestones in research ethics
- Definition and importance of research integrity
- Truthfulness and accuracy in data collection, analysis, and reporting
- The role of reproducibility and transparency

Unit II: Research Misconduct **5 hrs**

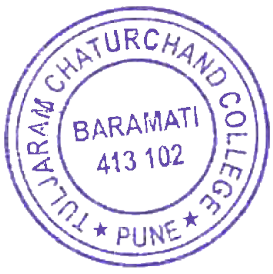
- Definitions and examples of research misconduct (fabrication, falsification, plagiarism - redundant publications, duplicate and overlapping publications etc.)
- Consequences of misconduct for researchers and the scientific community
- Procedures for reporting and addressing misconduct

Unit III: Authorship and Publication Ethics **2 hrs**

- Criteria for authorship and contributors
- Responsibilities of authors, reviewers, and editors
- Handling conflicts of interest and disclosures

Unit IV: Predatory Publishing and Misleading Journals **3 hrs**

- Characteristics of predatory journals and publishers
- How to identify and avoid predatory practices
- Strategies for ensuring publication in reputable journals



Unit V: Indexing and Citation Databases **5 hrs**

- Overview of indexing databases (e.g., PubMed, Scopus, Web of Science)
- Citation metrics and their role (e.g., impact factor of journal as per Journal Citations Report, SNIP, SJR, IPP, Cite Score - Metrics: h-index, g index, i10 Index, altmetrics)
- Understanding open access and its impact on research dissemination

Unit VI: Plagiarism and its Detection **5 hrs**

- Definitions and types of plagiarism
- Tools and techniques for detecting plagiarism
- Strategies for avoiding plagiarism and ensuring originality

Unit VII: Regulations and Guidelines **5 hrs**

- Overview of relevant regulations and guidelines (e.g., Belmont Report, Declaration of Helsinki)
- Institutional policies and procedures
- International standards and agreements

Evaluation

Internal Assessment:

Course 5: Research and Publication Ethics

Total Marks: 15

Objective Test : 15 Marks

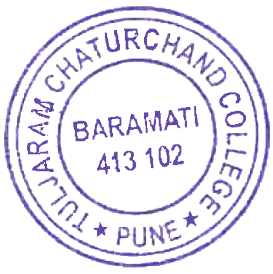
Final Examination:

Course 5: Research and Publication Ethics

Total Marks: 35

Time: 3 Hours **Max. Marks 35**

Q.1 Answer **any two** of the following questions on Unit One & Two. 10 Marks
Q.2 Answer **any two** of the following questions on Unit Three & Four 10 Marks
Q.3 Answer **any two** of the following questions on Unit Five and Six 10 Marks
Q.4 Answer **any one** of the following question on Unit Seven 05 Marks



Note

Marks and Credit Ratio:

- The total of 50 marks will finally be converted into 02 credits at the ratio of 25 marks for one credit. (In case of the fractional score of marks, the calculation of every credit shall be done as follows. The marks in the ratio of 0 to 12.5 value will be treated as 'zero' credit and the marks in the ratio of 13 to 25 value will be treated as 'one' credit.)

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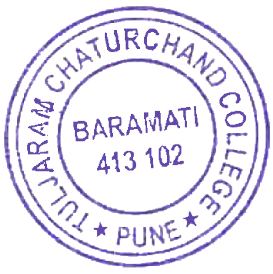

Course 6: Topic Related Seminars, Field Work, etc.

Total Credits: 1 **Marks: 25**

Objectives

1. To enable the students to undertake focused background reading
2. To enable them to use various tools and materials for research
3. To enable them to make effective presentations

Contents

This paper will be conducted in the form of field work, seminars, presentations etc.

Evaluation

Each student will be required to complete three assignments as follows.

1. **Assignment-1 (05 Marks)**
   Preparing anexhaustive bibliography (including online sources) related to the research area
2. **Assignment-2 (10 Marks)**
   A seminar (PPT) on the analysis of works/data related to the student's research topic
3. **Assignment-3 (10 Marks)**
   Presentation of Research Paper based on the student's research topic

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सावित्रीबाई फुले पुणे विश्वविद्यालय

विद्याशाखा : मानवविज्ञान विद्याशाखा

पीएच.डी. कोर्सवर्क

पाठ्यक्रम : हिंदी

शैक्षिक वर्ष : २०२४-२५ से

हिंदी पीएच.डी.छात्रों के लिए, परिवर्तित नियमानुसार प्रवेश प्राप्त करने के पश्चात कोर्स वर्क पूर्ण करना अनिवार्य है। प्रस्तुत पाठ्यक्रम में ऐसे विषयों का समावेश किया गया है जो शोध कार्य के लिए मार्गदर्शक सिद्ध होंगे।

प्रत्येक प्रश्नपत्र ४ क्रेडिट पॉइंट्स के लिए १०० अंकोंका होगा।

कुल १६ क्रेडिट पॉइंट्सका विभाजन इस प्रकार होगा :

क्र.	**पाठ्यचर्या का नाम**	**क्रेडिट**	**अंक**
१	शोध : स्वरूप, प्राविधि और प्रक्रिया	४	१००
२	तुलनात्मक साहित्य	४	१००
३	हिंदी भाषा और साहित्य : आंतरानुशासनीय अध्ययन	४	१००
४	शोध अभ्यास	४	१००

पाठ्यचर्या - १

शोध : स्वरूप, प्राविधि और प्रक्रिया

(४ क्रेडिट) १०० अंक

१. शोध का स्वरूप : शोध के लिए प्रयुक्त विभिन्न शब्द एवं उनका औचित्य, शोध विशेषतायें और उनका विश्लेषण, शोध के उद्देश्य, शोध की विवेचन पद्धति वस्तुनिष्ठता, तर्कसंगति, प्रमाणबद्धता ।

२. शोध और आलोचना।

३. शोध के मूल तत्व।

४. शोध के प्रकार : साहित्यिक, साहित्येत्तर, दोनों में साम्य-वैषम्य, अंत:संबंध, साहित्यिक शोध के प्रकार : वर्णनात्मक, ऐतिहासिक, तुलनात्मक, अंतर्विद्याशाखीय शोध का सामान्य परिचय।

५. शोध की प्रक्रिया : विषय-चयन, सामग्री संकलन, हस्तलेख-संकलन एवं उपयोगिता, सामग्री का विश्लेषण, निष्कर्ष स्थापना।

६. हिंदी से संबंधित तकनिकी ज्ञान : कम्प्यूटर-एम.एस. वर्ड, यूनिकोड, फोटोशॉप, कवर डिजाइनिंग, ग्राफ़िक्स, डी मल्टीमीडिया, इंटरनेट, वेबसाइट, इ-कॉमर्स आदि का सामान्य परिचय।

७. शोध-प्रबंध लेखन प्रणाली : शोध प्रबंध शीर्षक, निर्धारण, रुपरेखा, भूमिका-लेखन अध्याय-विभाजन, संदर्भ पाद टिप्पणी, सहायक ग्रंथ सूची, परिशिष्ट, टंकन, वर्तनी सुधार।

८. शोधलेख - लेखन प्राविधि, शोध सहिंता, (प्लगरीज़म) शोध सारांश लेखन।

संदर्भ ग्रंथ सूची :

१. शोध प्रविधि : डॉ. विनयमोहन शर्मा

२. शोध की प्रक्रिया : डॉ. सावित्री सिन्हा, डॉ. विजयेंद्र स्नातक

३. शोध का विवेचन : डॉ. उदयभानु सिंह

४. साहित्य सिद्धांत और शोध : डॉ. आनंद प्रकाश दीक्षित
५. हिंदी शोध तंत्र की रूपरेखा : डॉ. मनमोहन सहगल
६. शोध प्रक्रिया एवं विवरणिका : डॉ. सरनान सिंह शर्मा
७. शोध स्वरुप एवं मानक व्यावहारिक कार्यविधि : डॉ. वैजनाथ सिंहल
८. शोध विज्ञान कोश : डॉ. दू.का.संत, पुणे विद्यार्थी गृह प्रकाशन, पुणे

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पाठ्यचर्या–२

तुलनात्मक साहित्य

(४ क्रेडिट) १०० अंक

१. तुलनात्मक साहित्य : परिभाषा और स्वरुप, तुलनात्मक अध्ययन का महत्त्व

२. तुलनात्मक साहित्य : प्राविधि : कृति और साहित्यकार के संदर्भ में युग, दर्शन, साहित्य विधा, भाषा और तुलनात्मक अध्ययन

३. तुलनात्मक साहित्य : अध्ययन क्षेत्र

- एक भाषा के दो साहित्यकारों का तुलनात्मक अध्ययन
- एक भाषा के दो कृतियोंका का तुलनात्मक अध्ययन
- भिन्न भाषा के दो कृतियोंका का तुलनात्मक अध्ययन
- भिन्न भाषा के दो साहित्यकारों का तुलनात्मक अध्ययन

४. विधाओं का तुलनात्मक अध्ययन :

- एक या भिन्न भाषाओं की विधाओं का तुलनात्मक अध्ययन
- विधाओं के रूपांतरण का तुलनात्मक अध्ययन

५. अनुवाद : परिभाषा, स्वरुप और प्रिविधि

६. तुलनत्मक साहित्य में अनुवाद का महत्त्व

७. भारतीय साहित्य की अवधारणा

८. साहित्य और फिल्मांतरण

संदर्भ ग्रंथ सूची :

१. तुलनात्मक साहित्य : संपादक डॉ. राजमल बोरा

२. अनुवाद क्या है? : संपादक डॉ. राजमल बोरा

३. अनुवाद विज्ञान : डॉ. भोलनाथ तिवारी

४. अनुवाद स्वरुप : डॉ. सुरेशकुमार

५. अनुवाद सिद्धांत : डॉ. जी. गोपीनाथम

६. भारतीय साहित्य की भूमिका : डॉ. रामविलास शर्मा

७. भारतीय साहित्याची संकल्पना : संपादक डॉ. द. दि. पुंडे

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पाठ्यचर्या–३

हिंदी भाषा और साहित्य : आंतरानुशासनीय अध्ययन

(४ क्रेडिट) १०० अंक

१. साहित्य और विचारधारा

अ) भक्ति साहित्य के दार्शनिक आधार : अद्वैतवाद, विशिष्टद्वैतवाद, और सुफिवाद

ब) आधुनिक साहित्य के दार्शनिक आधार : मार्क्सवाद, अस्तित्त्ववाद, आंबेडकरवाद, उत्तर-आधुनिकतावाद, गांधीवाद, संरचनावाद, प्रकृतिवाद

२. साहित्य और भाषाविज्ञान

३. साहित्य और समाजविज्ञान : समाजशास्त्र, इतिहास, राजनीति

४. साहित्य और मनोविज्ञान

५. साहित्य और विज्ञान : विज्ञान कथा साहित्य, साहित्य और चलचित्र

६. साहित्य और विविध विमर्श

७. साहित्य और पर्यावरण

८. साहित्य और सौंदर्यशास्त्र

संदर्भ ग्रंथ सूची :

१. भाषा और समाज : डॉ. रामविलास शर्मा

२. साहित्य और इतिहास दृष्टि : डॉ. मैनेजर पांडेय

३. साहित्य का समाजशास्त्र : डॉ. रामविलास शर्मा

४. साहित्य कोश भाग १ : संपादक डॉ. धीरेन्द्र वर्मा, ज्ञान मंडल, वारणसी

५. उत्तर आधुनिकता साहित्य विमर्श : डॉ. सुधीर पचौरी

६. उत्तर आधुनिकता, और प्राच्य काव्यशास्त्र : डॉ. गोपीचंद नारंग, साहित्य अकादमी, नई दिल्ली

७. हिंदी साहित्य मे विविध वाद : डॉ. प्रेमनारायण शुक्ल, लोकभारती, इलाहबाद

८. भारतीय तथा पाश्चत्य काव्यशास्त्र : डॉ. सुरेशकुमार जैन, प्रा। महावीर कंडारकर, अन्नपूर्णा प्रकाशन, कानपूर

९. हिंदी साहित्य का इतिहास नये विचार नई दृष्टि : संपादक,डॉ. सुरेशकुमार जैन, वाणी प्रकाशन, नई दिल्ली

१०. अथातो सौंदर्य जिद्न्यासा : डॉ. रमेश कुंतल मेघ

११. भारतीय सौंदर्यशास्त्र की भूमिका : डॉ. नगेंद्र

१२. दलित साहित्य का सौंदर्यशास्त्र : शरणकुमार लिंबाले

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पाठ्यचर्या–४

शोध अभ्यास

(४ क्रेडिट) १०० अंक

१. क्षेत्रीय भेंट

२. पुस्तक समीक्षा

३. संगोष्ठी

४. शोधालेख

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Savitribai Phule Pune University

(Formerly University of Pune)

Faculty of Humanities

Board of Studies in Economics

Coursework Syllabus for Ph. D in Economics

To be implemented from Academic Year 2024-25

Savitribai Phule Pune University Pune
Ph.D. Course Work Syllabus - Economics (16 Credits)
(w.e.f. 2024-25)

Preamble

As per the University Grants Commission (UGC) guidelines the students who have admitted for Ph.D. in Economics will have to complete course work for one semester duration. The course work shall be treated as prerequisite for the Ph.D. Program. The course will have 16 credits.

The Ph.D. Course work shall consist of the following components;

Course	Name of the Course	Credits	Marks
Course 1	**Research Methodology** (Including Quantitative methods, Computer applications, review of published research in the relevant field, training, fieldwork, writing of research proposal for obtaining financial assistance from national funding agencies, etc.)	04	100
Course 2	Attending at least One Seminar/Conference/Workshop (National/International)	01	25
Course 3	Subject Specific Advanced Level Course - I	04	100
Course 4	Subject Specific Advanced Level Course - II	04	100
Course 5	Research & Publication Ethics	02	50
Course 6	Pedagogical Training / Industrial Visit Report / Assessment Statement	01	25
	Total	**16**	**400**

Syllabus

Course 1: Research Methodology

Credits: 04 Marks: 100

Course Objectives:

1) To Provide Research Methodology knowledge to the students
2) To skill the students towards the quantitative and qualitative methods used in research
3) To train the students towards the research techniques used in research.
4) To train the students towards the computer applications and its use in research.
5) To teach the students fundamentals in report writing
6) To introduce the students to national level research funding institutions.

Units and Contents

Unit 1 - Introduction **12 Hours**

1.1 - Meaning & Concept of Research
1.2 - Types and approaches of Research
1.3 - Importance and Limitations of research in Social Sciences
1.4 - Review of published research

Unit 2 - Research Design & Sampling **16 Hours**

2.1 - Defining the research problem
2.2 - Steps in research designing
2.3 - Good research design
2.4 - Sampling for research – Steps in research sampling
2.5 - Methods for sampling – Random and Non-Random Methods
2.6 - Characteristics of Good Sample for research

Unit 3 - Data Collection for Research **14 Hours**

3.1 - Types of Data: Primary and Secondary
3.2 - Methods to collect primary data.
3.3 - Difference between Questionnaire and Schedules
3.4 - Collection of secondary data

Unit 4 - Data Processing **18 Hours**

4.1 - Processing Operations for Primary Data
4.2 - Basic statistics in research – central tendency, dispersion, asymmetry, relationship, etc.
4.3 - Simple regression analysis.

4.4 - Hypothesis testing – methods.

4.5 - Use of Computer Applications – MS-Excel, Open-source software for data processing

References:

1. Bhandarkar P. L.and Wilkinson T. C. (2016), "Methodology and Techniques of Social research", Himalaya Publishing House, Mumbai.
2. William Josiah Goode, Paul K. Hatt (1952),"Methods in Social Research", McGraw-Hill Book Co., New York.
3. Krishnaswamy, O.R. (2010), "Methodology of Research in Social Sciences", Himalaya Publishing House, Mumbai.
4. Arunangshu Giri and Debasish Biswas (2018), "Research Methodology for Social Sciences", SAGE Publications India Pvt Ltd, New Delhi. Savitribai Phule Pune University, Pune | Syllabus for M.A. Economics Part - I Semester -I& II 31
5. M,Thamilarasan (2015),"Research Methodology for Social Sciences", New Century Publications, New Delhi.
6. Sharma, Prasad and Satyanarayana (1983), "Research Methods in Social Sciences", Sterling Publishers Private Ltd., New Delhi.
7. C.A. Moser, G. Kalton (2017),"Survey Methods in Social Investigations", eBook Published 5 January 2017.
8. Sadhu AN, Amarjit Singh (2007),"Research Methodology in Social Sciences", Himalaya Publishing House, New Delhi.
9. Kurein C. T. (1973), "A guide to research in Economics", Sangam Publishers for Madras Institute of Development Studies, Madras.
10. Devendra Thakur (2009), "Research Methodology in Social Sciences", Deep & Deep Publications, Delhi.
11. G.R. Basotia, K.K.N. Sharma (2009), "Research Methodology", Mangal Deep Publications, Jaipur.
12. Kothori C.R., Gaurav Garg (2019),"Research Methodology", New Age International Publishers, New Delh.
13. Gopal M.H. (1971), "Introduction to Research Procedure in Social Sciences", Asia Publishing House.
14. Khandhare V.B., Yadav Y., (2016), "Research Methodology", Chinmay Publication, Aurangabad.
15. Sharma, B.A.V.; D. Ravindra Prasad, P. Satyanarayana(1983), "Research Methods in Social Sciences", Sterling publishers, New Delhi.
16. Thakur Devendra (2009), "Research Methodology in Social Sciences", Deep and Deep Publications, Delhi.
17. Young P.V. (1984), "Scientific Social Survey and Research", Prentice Hall,India

18. Aaglave Pradeep, (2020), “Samajik Sanshodhan : Paddhatishastra Wa Tantre”, Shree Sainath Prakashan, Nagpur.

Pattern of Evaluation:

Time: 3 Hours

Total Marks: 100 (Minimum Passing Marks: 40%)

Question Paper Pattern -

Q1. Answer the Following Multiple Choice Questions (Any 10 out of 12)	20
Q2. Write a note on the adoption of quantitative methods.	20
OR	
Write a note on the use of computer applications in research	20
Q3. Review of Literature on research topic	20
Q4. Prepare a research proposal	40

Course 2:

Attending at least One Seminar/Conference/Workshop (National/International)

Credits: 01 Marks: 25

Nature of the Course:

Students admitted for Ph.D. program in Economics have to attend/ participate in the seminars at state/national/International level organized by various educational institutes. The certificate of Participation/Attendance will have 25 Marks which is equal to One Credit.

Course 3

Subject Specific Advanced Course - I

Theories in Economics

Credits: 04 Marks: 100

Objectives:

1) To introduce economic theories to the students
2) To develop ability among the students in response to theories in economics
3) To introduce basic principles of theories in economics to the students
4) To explore theoretical base for research in economic

Units & Contents

Unit 1 - Theories of Economic Growth **16 Hours**

1.1 - Classical Theories – Adam Smith, David Ricardo, Malthus
1.2 - Harrod-Domar Model, theory of Big Push
1.3 - Lewis theory of economic development
1.4 - Neoclassical theory – Robert Solow
1.5 - New Growth Theory

Unit 2 - Theories of International Trade **14 Hours**

2.1 - International Trade and Economic Growth
2.2 - The Heckscher-Ohlin Theorem
2.3 - Product Life Cycle and Technology Gap Models
2.4 - Krugman's New Economic Geography

Unit 3 - Public Finance and Welfare **15 Hours**

3.1 - Economic Activities of the State
3.2 - Principle of Maximum Advantage
3.3 - Public Revenue Policy
3.4 - Public Expenditure Policy

Unit 4 - Market Economics **15 Hours**

4.1 - Consumer Behaviour – Utility, Consumer Surplus
4.2 - Demand analysis – Law of Demand, Elasticity of Deman – Types
4.3 - Supply Analysis – factors of production, cost & revenue concepts
4.4 - Laws to returns, Law of variable proportions

References:

1. Thirlwall, A.P. (1999), (6th Edition), Growth and Development, Macmillan, U.K.

2. Todaro, M.P. (1996), (6th Edition), Economic Development, Longman, London.
3. International Economics Srivastava, O.S Kalyani Publishers 2012 Ludhiyana
4. International Economics Soderston, Bo the Macmillan Press Ltd 2005 London
5. Musgrave, Richard A and Musgrave, Peggy B (1989), Public Finance in4. Theory and Practice, Tata McGraw Hill, New Delhi.
6. Advanced Economic Theory Ahuja H.L. S. Chand & Company Ltd. 2004 New Delhi
7. Micro Economics D.N. Dwivedi Pearson Publication 2011 New Delhi
8. Advanced Microeconomic Theory Misra S.K. and V.K. Puri Himalaya Publishing House 2001 New Delhi
9. Micro Economics Mansfield, E. W. W. Norton and Company 1997 New York

Pattern of Evaluation:

Time: 3 Hours

Total Marks: 100 (Minimum Passing Marks: 40%)

Question Paper Pattern and Marks

Q1. Answer the Following Multiple Choice Questions (Any 10 out of 12)	20
Q2. Answer the Following Questions (Any Five out of Six)	30
Q3. Answer the Following Questions (Any Five out of Seven)	50

Course 4

Subject Specific Advanced Course - II

Development Economics

Credits: 04 Marks: 100

Objectives:

1) To develop an ability among the students to evaluate nexus between agriculture growth and economic development
2) To evaluate the role of labour issues in economic development
3) To understand sources and changing structure of financial institutes in India
4) To Have a Review of development strategies in India

Units & Contents

Unit 1 - Agriculture and Economic Development **15 Hours**

1.1 - Role of Agriculture in Economic Development

1.2 - Changing Status of agriculture in economic development

1.3 - Climate change and agriculture in India

1.4 - Barriers in agriculture development

1.5 - Agriculture Marketing and Agricultural Prices in India.

Unit 2 - Labour and Employment **15 Hours**

2.1 - Meaning and concept of Labour

2.2 - Labour Economics – Nature, Scope and Importance

2.3 - Labour Market in India – Characteristics

2.4 - Labour Force and Work Force: Meaning and nature

2.5 - Formal and informal employment – status and problems

Unit 3 - Banking and Finance in India **15 Hours**

3.1 - Structure of Financial System in India

3.2 - Financial Sector reforms in India

3.3 - Growth of Banking and non-banking financial institutions in India

3.4 - Growing Importance of Insurance

Unit 4 - Development Strategies in India **15 Hours**

4.1 - Replacement of planning commission by NITI Ayog

4.2 - Poverty Eradication programmes – Food security, Awas Yojna

4.3 - Employment Generation Programme – for Rural and Urban

4.4 - Promotion to industrial output

4.5 International agreements and foreign trade policies

References:

1. Lekhi R.K. & Singh J. (2013),'Agricultural Economics', Kalyani Publisher, New Delhi.
2. .Reddy, Ram, Sastry & Devi (2010), 'Agricultural Economics', Oxford & IBH Publishing Co. Pvt.Ltd., New Delhi.
3. R.G. Desai (2001), 'Agricultural Economics- Madels Problems and Policy Issues' Himalaya Publishing House, Mumbai.
4. Keynes, J. M. (1935). The General Theory of Employment, Interest and Money. Atlantic Publishers and Distributors (P) Ltd, New Delhi, India.
5. Roy B Helfgott: Labour Economics. Random House New York (1973).
6. Ahluwalia I.J. (1985), 'Industrial Growth in India' Oxford University Press, New Delhi.
7. Barthwal R.R. (2019), 'Industrial Economics,' New Age Publications

Pattern of Evaluation:

Time: 3 Hours

Total Marks: 100 (Minimum Passing Marks: 40 %)

Question Paper Pattern -

Q1. Answer the Following Multiple Choice Questions (Any 10 out of 12)	20
Q2. Answer the Following Questions (Any Five out of Six)	30
Q3. Answer the Following Questions (Any Five out of Seven)	50

Course 5

Research and Publication Ethics

Credits: 02 Marks: 50

Notification

UGC mandated a Two-Credit course on Research and Publication Ethics From the academic year 2021-22, the Centre for Publication Ethics (CPE) is conducting University Grants Commission approved (UGC Notification - D.O.No.F.1-1/2018) (Journal/CARE) a two-credit course entitled "Research and Publication Ethics" (RPE) for all registered Ph.D. students for pre-registration course work (SPPU circular no. 103/2021 dated 8th April 2021).

Overview:

This course has total six units focusing on basics of philosophy of science and ethics, research integrity, publication ethics. Hands-on-sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research metrics (citations, h-index, Impact Factor, etc.) and plagiarism tools will be introduced in this course. More details about the course are mentioned below:

Objectives:

1) To create awareness among students about ethical practices in research work
2) To promote them to adopt ethical ways in research
3) To alert them from drawbacks of malpractices in research and its side effects for them
4) To explain them the benefits of research based on ethics

Course Level: Two Credit course (30 hrs.)

Course code: CPE-RPE

Eligibility: Registered Ph.D. students

Number of seats: As per University rules

Fees: As per University rules

Faculty: Interdisciplinary studies

Course duration: One month

Start date: As per University notes

Qualifications of faculty members of the course: Ph.D. in relevant subject areas having more than 10 years of teaching experience.

Pedagogy: Online classes, group discussions, and online practice sessions.

Evaluation: Continuous assessment will be done through tutorials, assignments, quizzes, and group discussions. Weightage will be given for active participation. Final online examination will be conducted at the end of the course as per the university rules and regulations.

Online Registration:

http://bcud.unipune.ac.in//PHDTracking/PhdStud_Signup/Login.aspx

Syllabus Link: Course structure
https://ugccare.unipune.ac.in/Apps1/content/files/December%202019%20syllabus-rpe-ugc.pdf

References:

1. Singh, Ahlawat, Sharma (2023), Research & Publication Ethics, S. Chand & Sons Ltd, New Delhi.
2. Sadhu AN, Amarjit Singh (2007),"Research Methodology in Social Sciences", Himalaya Publishing House, New Delhi.
3. Kurein C. T. (1973), "A guide to research in Economics", Sangam Publishers for Madras Institute of Development Studies, Madras.
4. Devendra Thakur (2009), "Research Methodology in Social Sciences", Deep & Deep Publications, Delhi.
5. G.R. Basotia, K.K.N. Sharma (2009), "Research Methodology", Mangal Deep Publications, Jaipur.
6. Kothori C.R., Gaurav Garg (2019),"Research Methodology", New Age International Publishers, New Delh.
7. Gopal M.H. (1971), "Introduction to Research Procedure in Social Sciences", Asia Publishing House.
8. Yogita Sharma, Arti Sharma (2021), Research & Publication Ethics, Kalyani Publication.

Course 6

Pedagogical Training /Industrial Visit Report/Assessment Statement

Credits: 01 Marks: 25

The nature of the course will be in the form of report preparation on the basis of industrial/field visits OR participation in pedagogical training programmes.

Pattern of Evaluation:

The students will have to complete any one of the following assignments. Submission of the assignment will carry 25 marks of the course.

1) A study report on an industrial/Field visit

2) A book review on any of the reference books in economics

3) A PPT presentation on any topic in economics.