



Shri Vile Parle Kelavani Mandal's

**MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE
OF SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF
COMMERCE AND ECONOMICS
(AUTONOMOUS)**

NAAC Reaccredited "A" grade, CGPA: 3.57,
Granted under FIST-DST & Star College Scheme of DBT, Government of India
Best College, University of Mumbai 2016-17

**Affiliated to the
University of Mumbai**

Program: M.Phil. / Ph.D. Course work
Course: Botany

**Credit Based Semester and Grading System (CBSGS) with effect
from the academic year 2019-20**

PREAMBLE

The PhD Research Centre of Botany Department under the aegis of SVKM's Mithibai College of Arts, Chauhan Institute of Science and Amrutben Jivanlal College of Commerce and Economics (Autonomous) is a well-established centre since 2011-12 with well experienced faculty and excellent facilities for research. With autonomous status granted to Mithibai College, comes an opportunity to promote cutting-edge research in the field of plant sciences and related disciplines steered to promote a multi-disciplinary approach through quality research.

A Ph.D degree is awarded in recognition of work of high academic standards, resulting from creative and independent work pushing the frontiers of our knowledge, developing new theories or technology or enhancing our understanding of various processes, event or phenomenon in different disciplines.

Plants are one of the most fascinating and important groups of organisms living on Earth. They serve as the conduit of energy into the biosphere, provide food, and shape our environment. If we want to make headway in understanding how these essential organisms function and build the foundation for a more sustainable future, then we need to apply the most advanced technologies available to the study of plant life.

In this regard, the Department of Botany, Mithibai College (Autonomous) is committed to broad based programs at all levels and encourages multi-disciplinary work across disciplines, departments and institutions. The Ph.D. guides from the department of Botany, endeavors to promote recent research in plant sciences and allied areas encompassing various specializations viz. angiosperm taxonomy, plant anatomy, plant physiology, medicinal botany, mycology, ecology, ethnobotany to name a few in conjunction with the recent trends in plant sciences.

The structure of the Ph.D course work is strictly in accordance with the UGC regulations for Minimum Standards and Procedure as adopted by the Governing Body of Mithibai College (Autonomous).

Each Ph.D. student will have to undergo a 12-credit course-work, and complete the credits in first two semesters. The course work consists of three papers of 4 credits each. It comprises course on research methodology, advanced subject related content essential for the research and IPR. Course focuses on skill enhancement. This course also includes non-credit topics such as communication skills, computer skills. These will help students in their publication, conference presentation and proper scientific way of thesis writing.

At the end of two semesters student will be ready to initiate research project.

The course therefore aims at grooming the students gradually from building their scientific temper, to development of communication skills and from training them in relevant computer applications to steering publications, presentations and writing synopsis and thesis. The course at the end of 2 semesters will further enable scholars to distinguish between the scientific method and common sense knowledge while laying the foundation for research skills at higher levels making him/her ready to initiate the research project.

Attendance Requirements

Research scholars shall be required to attend all the lectures and participate in journal club activity, guest lectures, seminars, workshops and industrial visit either arranged by the college or by the research centre. The attendance will be as per the rules and regulation as described in examination and evaluation guidelines of the college.

Examination & passing standard

Written examination will be conducted by the research centre as given along description of the paper. All the research scholars admitted to the M.Phil./Ph.D programme shall be required to complete the coursework prescribed by the Department within first two semesters.

All M.Phil/ Ph.D. scholars has to obtain a minimum of 55% of marks or credits wherever applicable or its equivalent grade in the UGC 7-point scale (or an equivalent grade/CGPA in a point scale) in the coursework in order to be eligible to continue in the programme.

Coursework Exemption and Rules

As per the rules and regulation as described in examination and evaluation guidelines.

Details about the Papers in Coursework

Paper No.	Papers	Total hours	Credits	Mode of assessment
101	Research Methodology	60	4	100 marks Examination at the end of course
102	Area specific basic paper	60	4	Continuous evaluation, contribution to syllabus development
103	Skill development	60*	4	Continuous evaluation Practical assessment/viva voce/seminar/ written literature review on any topic related to advancement in area of research, and viva voce on assignment
	Soft skills Communication skill, Presentation skills, Computing skills (use of software relevant to research) e.g. use of Microsoft EXCEL, Microsoft Access. SPSS, SAS, Corel draw	30	(non-credit)	Completion certificate from research guide

*-seminars/workshops/Journal club/visit to research institute.

- 1 credit- **15 hours of classroom learning and 30 hours of practical's (if any)**
- Journal club/seminars/guest talks/research organisation visits **Not more than 2 credits.**
- Paper-101 & 102 course work can either be completed in Research centre or student can register and complete the course from SWAYAM, MOOC, NPTEL, Course is equivalent to course work credit. Credit will be assigned only on the basis of submission of certificate.

Paper-I (Course No. 101)			
Unit number	General	Number of hours	Number of credits
Unit I	<p>Research methodology: Strategies, planning and analysis: Objectives of research, short term and long term goals, research conditions, research design- characteristics of a good research design, types of research design Experimental protocols Literature search: Systematic literature search, Search techniques, Impact factor, Citation style Ethics in science: Introduction to ethics, Scientific conduct and misconduct, Plagiarism, Ethics of animal research- CPCSEA, Institutional ethics committee, OECD guidelines</p>	15	01
Unit II	<p>Biostatistics - introduction: Introduction- definition, scope and limitations Collection of data, classification & tabulation- diagrammatic & graphical representation Measures of dispersion - Range, Q.D., M.D., variance, standard deviation Correlation and Regression analysis: Correlations and regressions principles of least squares, Two regression lines, curve fitting Karl Pearson's coefficient of correlation, Spearman's coefficient of correlation</p>	15	01
Unit III	<p>Data Analysis: Mathematical and statistical analysis using software tools like MAT Lab, SPSS, Psi LAB or free ware tools. Hypothesis testing: Null and alternate hypothesis, Type-I & Type-II errors, Level of significance, Power of test, p value</p>	15	01
Unit IV	<p>Parametric tests: Large sample Tests, Testing significance of single population proportion, Testing significance of two population proportion, Small sample Tests, χ^2 test, Testing single population variance, Testing association between two attributes, F-test, Testing equality of variance, ANOVA / ANCOVA - one-way classification, two-way classification. Introduction to non-parametric tests: The Mann-Whitney Test (Mann-Whitney-Wilcoxon test -for equality of medians), The Kolmogorov-Smirnov Goodness-of-Fit Test, The Kruskal-Wallis One-Way Analysis of Variance by Ranks, The Friedman Two-Way Analysis of Variance by Ranks</p>	15	01

Reading Resources:

- Research Methodology: A guide for Researchers in Agricultural Science, Social Science and other related fields. Pradipkumar Sahu. Springer 2006
 - Ranjit Kumar, 2005 Research Methodology- A step-by-step Guide for beginners, 3rd edition, Sage publications.
 - Fundamentals of Research methodology and statistics- Yogesh Kumar Singh, New Age International Publishers
 - Biostatistics: A foundation for analysis in health sciences. Daniel WW, Cross CL. 10thEdn, Wiley.2013
 - Biostatistical Analysis. Zar JH. 5th Edition Pearson Education.2010.
 - Principles of Biostatistics. Pagano M., Gauvreau K., 2ndEdn. Cengage Learning, 2010
 - Fundamentals of Biostatistics. Rosner B. 7thEdn. Duxbury Thomson 2011
 - Introductory Applied Biostatistics D'Agostino RB., Sullivan LM., Beiser AS., Thomson Brooks/Cole 2006
 - Communications Skills: Sanjay Kumar & PuspLata, 2nd edition, Oxford University Press
 - An Introduction to Professional English and Soft Skills by B.K. Das et al., Cambridge University
 - Good Laboratory Practice: Nonclinical Laboratory Studies Concise Reference. Allport-Settle MJ. PharmaLogika. 2010
 - Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Bouchoux D. 3rdEdn. Delmar Cengage Learning. 2009.
 - Office of the Controller General of Patents, Designs & Trade (CGPDTM): Manual of Geographical Indications Practice and Procedure
 - Office of the Controller General of Patents, Designs & Trade (CGPDTM): Manual of Patent Office Practice and Procedure
 - Office of the Controller General of Patents, Designs & Trade (CGPDTM): Manual of Designs Practice and Procedure
 - Office of the Controller General of Patents, Designs & Trade (CGPDTM): Revised Draft Manual of Trademarks Practice and Procedure
 - WIPO: WIPO Guide to Using Patent Information
 - WIPO: Intellectual Property (IP) Audit
 - WIPO: WIPO Patent Drafting Manual
 - WIPO: The Value of Intellectual Property, Intangible Assets
- Any other reference sources as recommended by the course instructor.

Paper-II (Course No. 102)			
Unit number	Subject based	Number of hours	Number of credits
Unit-I	Cell Biology	15	1
	Cell cycle and control: Check points, Cyclins and CDKs and apoptosis, Cancer biology- Cell cycle regulation, apoptosis, autophagy, senescence, Hallmarks of cancer, angiogenesis and metastasis, Oncogenes and tumor suppressors, epigenetics, Cancer biomarkers, Cell culture, primary cell lines, continuous cell lines, maintenance of cell lines, cell toxicity assays, Cell analysis- Flow Cytometry; Cell proliferation assays, Cell death analysis, immunohistochemistry, blotting techniques, comet assay.		
Unit-II	Molecular Biology techniques and bioinformatics	15	1
	PCR: Basics, factors affecting PCR, applications, variations in PCR, nucleic acid sequence based amplification assays (NASBA) and transcription – mediated amplification assay (TFA); Real Time PCR, Nucleotide sequencing: Chemical and enzymatic methods, Pyrosequencing, Automated DNA sequencing, PCR fragment analysis, Next Generation sequencing Microarray Technology: Proteomics, Metagenomics, Use of bioinformatics tools in research (Hands on training /practical learning) sequence alignment, global, local, multiple, phylogenetic analysis (use of 16srDNA technique). Molecular docking using software		
Unit-III	Bioprocess and enzyme technology	15	1
	Enzymes: commercial applications; Production of industrially important enzymes, medically important enzymes such as diagnostic, therapeutic enzymes, Enzyme purification techniques- conventional and advance, Recombinant enzymes-kinetics, Upscaling of production of enzymes, Enzyme immobilisation- kinetics of immobilisation, development of new techniques, application, Microbial products, System biology		
Unit-IV	Ecology and Ecosystems	15	1
	Carbon sequestration, Limno-ecological studies: Physiochemical parameters, Edaphic factors, Proximate composition, Pollutants in environments, Study of Air quality index. Methods in study of biodiversity & fishery science.		
Unit-V	Nanotechnology	15	1
	Types of nanoparticles-classification, Methods for synthesis of Nanoparticles-Methods, assembly,		

	stabilisation, Characterisation of nanoparticles, Applications		
Unit-VI	Introduction to Pharmacology	15	1
	Physico-chemical properties of drug, drug-receptor, interaction, Pharmacokinetics, Pharmacodynamics, Pharmacotherapeutics, Drug interactions, Nature and sources of Drugs, Drug nomenclature and dosage forms, Routes of drugs' administration; advantages and disadvantages of different routes, Drug discovery and development, Drug regulatory affairs, Herbal drugs - Methods of extraction of active constituents, standardisation of herbal drugs, regulatory issues with herbal drugs, regulatory requirement in herbal drugs in India, Drugs for various systems, Drug Toxicity- OECD guidelines Acute, sub-acute and chronic toxicity studies , Carcinogenicity, teratogenicity, genotoxicity, mutagenicity, Definition of Toxicological Dose Descriptors (LD ₅₀ , LC ₅₀ , EC ₅₀ , NOAEL, LOAEL/NOEC, DT ₅₀)		

Paper-III (Course No. 103)			
Unit number	Skill Development & Enhancement In Research	Number of hours	Number of credits
UNIT-1	INSTRUMENTATION: Good laboratory practices, Separation analytical techniques, chromatographic techniques, conventional and advance techniques, TLC, GC, affinity, ion exchange, size exclusion, supercritical fluid, HPTLC, Electrophoretic technique, Spectroscopic techniques- UV, FTIR, ESR, NMR, Circular Dichroism, Raman, ORD, Atomic absorption spectrometry, Microtomy.	15	1
UNIT-II	Intellectual property rights: Patents- Introduction to patents, patent databases, Preparation of Patent documents, patent examination, Patent infringement, recent development in patent system, Geographical indications, Trademarks, Copy rights, Management of intellectual property, Business & Intellectual property	15	1
UNIT-III	Communication skill: Presentation skills, Journal club, seminars, Skill enhancement workshops, visit to research institutes/industries	30	1
Unit-IV	Computing skills (use of software relevant to research): Use of Microsoft EXCEL, Microsoft Access, SPSS, SAS, Corel draw, Photoshop, Photomicrogyphy, Photographing & Photographic materials, Common faults in photography.	30	1

Reading Resources

- Research Methodology: A guide for Researchers in Agricultural Science, Social Science and other related fields. Pradip kumar Sahu. Springer 2006
- Ranjit Kumar, 2005 Research Methodology- A step-by-step Guide for beginners, 3rd edition, Sage publications.
- Fundamentals of Research methodology and statistics- Yogesh Kumar Singh, New Age International Publishers
- Biostatistics: A foundation for analysis in health sciences. Daniel WW, Cross CL. 10thEdn, Wiley.2013
- Biostatistical Analysis. Zar J.H. 5th Edition Pearson Education.2010.
- Principles of Biostatistics. Pagano M., Gauvreau K., 2ndEdn. Cargege Learning, 2010
- Fundamentals of Biostatistics. Rosner B. 7th Edn. Duxbury Thomson 2011
- Introductory Applied Biostatistics D'Agostino RB., Sullivan LM., Beiser AS., Thomson Brooks/Cole 2006
- Molecular Biology of the Cell – Albert, Johnson, Lewis, Raff, Roberts &Walter, 3rd edition
- Molecular Cell Biology. Lodish, Birk, and Zipursky. 6th edition Freeman
- Cooper, G.M., Hausman R.E. (2009) The Cell: A Molecular Approach- 5th edition. ASM Press.

- Karp G. (2002). Cell and Molecular Biology: Concepts and Experiments. 3rd edition. John Wiley & Sons.
- Culture of animal cells: Ian Freshney, 5th edition, John Wiley & Sons.
- Clive R. Newton, Alex Graham. (1997) PCR; BIOS Scientific Publishers.
- **Nanotechnology: Principles and Practices: Kulkarni**, Sulabha K, 3rd edition, Springer
- Mount, D. W. (2001) Bioinformatics: sequence and genome analysis. Cold Spring Harbor Laboratory Press, New York.
- Introduction to Bioinformatics T.K. Attwood and D.J Perry-Smith
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by Baxevanis A.D. and Ouellette, Third Edition. John Wiley and Son Inc., 2005
- Communications Skills: Sanjay Kumar & PuspLata, 2nd edition, Oxford University Press
- An Introduction to Professional English and Soft Skills by B.K. Das et al., Cambridge University
- Skoog, Holler and Nieman, Principles of Instrumental Analysis, 5th Ed. Australia, Thomson Brock/Cole.
- Wilson K., and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology, Seventh Edition; Cambridge University Press
- Pharmacokinetic in Drug Discovery and Development. Schoenwald RD. CRC Press. 2010.
- Principles and Methods of Toxicology. Hayes W, Kruger CL. CRC Press – Taylor & Francis Group. 2013.
- An Introduction to Medicinal Chemistry. Patrick GL. 5thEdn. Oxford University Press. 2013.
- Good Laboratory Practice: Nonclinical Laboratory Studies Concise Reference. Allport-Settle MJ. PharmaLogika. 2010
- Bajpai P.K. Biological Instrumentation & Methodology S.Chand Publication Edd.2010.
- Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Bouchoux D. 3rdEdn. Delmar Cengage Learning. 2009.
- Office of the Controller General of Patents, Designs & Trade (CGPDTM): Manual of Geographical Indications Practice and Procedure
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- Office of the Controller General of Patents, Designs & Trade (CGPDTM): Revised Draft Manual of Trademarks Practice and Procedure
- WIPO: WIPO Guide To Using Patent Information
- WIPO: Intellectual Property (IP) Audit
- WIPO: WIPO Patent Drafting Manual
- WIPO: The Value of Intellectual Property, Intangible Assets
- Any other reference sources as recommended by the course instructor.

The record of the evaluation is to be maintained till the learner clears his/her Ph.D. degree.

Sevenpoint scale will be followed for assigning the final grade. Learner should get minimum 'C' grade to qualify.

After completion of the Course Work guiding teacher will submit the Certificate of Completion of Course Work in the prescribed format:

Name of the Research Centre:

CERTIFICATE

This is to certify that Mr/Ms/Mrs.....

(Surname)

(First Name)

(Second Name)

Has been regular student of Ph.D. with registration number He/She attended the Course Work conducted at the recognized research centre/department from To during the year He/She has successfully completed the Ph.D. Course Work. He/She secured grade in seven point scale.

Date:

Guiding Teacher

Head of the Department/Principal

Seal

Name:

Name: