



Institute of Botany
Faculty of Life Sciences
University of the Punjab, Lahore
Course Outline
Semester – VII



Programme	BS Botany	Course Code	Bot-406	Credit Hours	2
Course Title	Scientific Inquiry and Research Methods (Theory)				
Introduction					
Human quest for scientific research and its importance in Economic Development, basic concepts about scientific research related terms, understanding scientific research lifecycle, types of data and scientific research, quantitative and qualitative research in Botany, beginning with scientific research, statistically valid experimental design for high quality research, Collecting, analyzing, presenting and describing data in Botany, developing manuscript (thesis/dissertation) on Botanical Research, ethics in scientific research.					
Learning Outcomes					
After completing this course, the students will be able to:					
<ul style="list-style-type: none"> • Think independently as a researcher • Inquire about the scientific literature to find gaps and lapses • Plan research independently • Develop their own research proposals and projects 					
Course Contents					
<ul style="list-style-type: none"> • Human quest for scientific research and its importance in Economic Development: human instinct and intellect behind scientific inquiry, introduction to research and its economic importance, definition by OECD (UN), concept of novelty and innovation, scientific research needed for economic development of Pakistan, knowledge-based economy, scientific research to create career opportunities. • Basic concepts about scientific research related terms: data, information and knowledge, concept of data, its characteristics and types, information, its characteristics and types, CARS analyses of source of information, knowledge, its characteristics and types. • Understanding scientific research lifecycle: process of beginning and conducting research, initial planning and designing a research project, acquiring funding of a research idea, from thesis to publishing articles, disseminating tangible research-based outcomes back to the society, beyond publishing, research articles to inventions/discoveries, from inventions/discoveries to patents, research-based entrepreneurship. • Types of data and scientific research: recap of variables and data, characteristic data types defining research types viz., qualitative and quantitative, inductive and deductive, parametric and nonparametric, exploratory, conclusive, predictive (modeling), algorithmic, etc. • Quantitative and qualitative research in Botany: quantitative research in Botany, advantages and disadvantages of quantitative research in Botany, qualitative research in Botany, advantages and disadvantages of qualitative research in Botany. • Beginning with scientific research: identifying and validating area of research interest, identifying and validating defining problem statement based on gaps and lapses in the scientific literature, conceptualizing and validating research title for defining aim and objectives, defining hypothesis (es and related range of independent and dependent variables, defining feasibility of the conceptualized research title. • Statistically valid experimental design for high quality research: concept of experimental units of the experimental design, understanding factor and treatment(s), understanding repeated and replicated observations, deriving experimental units of the experimental design, minimum requirements of statistically validity, common types of factorial experimental designs. • Collecting, analyzing, presenting and describing data in Botany: designing data collection sheets in MS Excel for applying descriptive (summary) and analytical statistics on Botanical data, applying chosen types of analytical 					

statistics on data, presenting and describing data visuals derived for Botanical data, describing data in descriptive and inferential way.

- **Developing manuscript (thesis/dissertation) on Botanical Research:** writing science clearly, writing basics, concept of outline, concept of cohesion and coherence in writing, writing thesis/dissertation writing major components of thesis/dissertation.
- **Ethics in scientific research:** concept of similarity index (SI) and originality index, concept of artificial intelligence (AI) and originality index in thesis manuscript, bringing SI and AI of a thesis manuscript within allowed limits, concept of plagiarism, definition, sources and types of plagiarism, codes and policies on research ethics, qualities of a good researcher, criteria for authorship and acknowledgements.

Programme	BS Botany	Course Code	Bot-407	Credit Hours	1
Course Title	Scientific Inquiry and Research Methods (Lab)				
Lab Course Contents					
<ul style="list-style-type: none"> • Hands-on activity using selected Academic databases • Hands-on activity browsing and saving need-based scientific literature • Hands-on activity managing collected information • Hands-on activity reading and drawing notes of scientific literature • Hands-on activity improving scientific writing of thesis chapters • Hands-on activity citing sources of information correctly as bibliography and references manually and by using software • Hands-on activity developing data collection sheet in MS Excel • Hands-on activity recording and entering the observed data in MS Excel • Hands-on activity summarizing data by applying descriptive statistics in MS Excel • Hands-on activity analyzing data by applying selected analytical statistics in MS Excel • Hands on activity writing research proposals 					
Textbooks and Reading Material					
<ol style="list-style-type: none"> 1. Youdeowei, A., Stapleton, P., Obubo, R. (2012). Scientific Writing for Agricultural Research Scientists - A Training Resource Manual. Wageningen, The Netherlands: CTA. 2. Chasan-Taber, L. (2014). Writing Dissertation and Grant Proposals. CRC Press, USA. 3. Oster, S., Cordo, P. (2015). Successful Grant Proposals in Science, Technology, and Medicine A Guide to Writing the Narrative. Cambridge University Press, Cambridge, UK. 4. Creswell, J. W. (2018). Research design: Qualitative, Quantitative and Mixed methods approaches. 5th Ed. Thousand Oaks, CA: Sage. 5. Leedy, P. (2004). Practical Research: Planning and Design (8th Edition), Jeanne Ellis Ormrod. 6. Gomez, K.A., Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. 2nd Ed. A Wiley-Interscience Publication John Wiley & Sons, New Yor, USA. 					
Teaching Learning Strategies					
<ul style="list-style-type: none"> • Lectures • Group Discussion • Laboratory work • Seminar/ Workshop 					
Assignments: Types and Number with Calendar					
<ul style="list-style-type: none"> • Lecture Based Examination (Objective and Subjective) • Assignments • Class discussion • Quiz • Tests 					
