Programme	BS Botany	Course Code	BOT-407	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:

- 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

- **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.