INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
PhD-17 SHORT ABSTRACT OF THESIS

Name of the Student	:	Subhradeep Kar
Roll Number	:	226122022
Programme of Study	:	Ph.D.

Thesis Title: Exploiting Ring Strain in C-C and C-Heteroatom Bond Formation: Access to Spiro and Fused Indole-Based Heterocycles

Name of Thesis Supervisor(s)	:	Prof. Tharmalingam Punniyamurthy and Prof. Vishal Trivedi
Thesis Submitted to the Academic Division	:	Yes
Date of completion of Thesis Viva-Voce Exam	:	03-02-2026
Key words for description of Thesis Work	:	Indole, Strained rings, Cycloaddition, Tandem annulation, Heterocycles, Spirocycles

---

SHORT ABSTRACT

Chapter I covers a Bi(III)-catalyzed formal (3+2)-cycloaddition of mono-activated spirocyclopropanes with inexpensive dithianediols as the sulphur surrogates. This chapter demonstrates the *de novo* utilization of spirocyclopropanes as 1,2-zwitterionic synthons rather than the well-established classical 1,3-zwitterion. **Chapter II** describes a Cu(II)-catalyzed tandem (4+3)-annulation of 4-vinyl indoles with N-sulfonylated aziridines to afford functionalized azepinoindole scaffolds. The described protocol allows for the one-pot construction of structurally diverse core skeletons inherent in numerous natural products and bio-active molecules. Further, in presence of a chiral ligand, the asymmetric version of the protocol succeeded efficiently to produce optically active scaffolds in up to 90% ee. **Chapter III** describes a Cu(I)-catalyzed (4+3)-cycloaddition of 4-indolyl carbinols with N-sulfonylated aziridines to deliver privileged azepinoindole derivatives in moderate to good yields. Utilizing 4-indolyl alcohols as valuable alkylidene indoleninium ion precursors for dehydrative annulation with aziridines could lead to generation of structurally diverse biorelevant azepinoindole skeletons by suppressing the undesired Mannich (3+2)-cycloadduct. **Chapter IV** illustrates a Co(II)-catalyzed cascade (4+3)-annulation of 4-alkylidene indole malonates with oxiranes to deliver indole fused oxepine motifs in a diastereoselective manner. The protocol displayed broad substrate scope with respect to oxiranes and a series of substituted indolyl malonates. Moreover, with enantioenriched oxiranes, the protocol followed the chirality transfer, delivering optically active moieties in up to ≥95% ee.