The whole of science is nothing more than a refinement of everyday thinking

*Albert Einstein*

**Preface**

In this thesis, an extensive study on the design and synthesis of novel achiral unsymmetrical bent-core molecule based on four benzene rings are presented. In addition, the influence of substituent and linking moiety on these materials are highlighted to explore some general structure-property relationships, chiral behaviour and realization of nematic phase along with photochromic azo moiety as a bridge between the aromatic cores, which can light induced undergo trans-cis isomerization. The organized thesis is as follows.

**Chapter 1** deals with the general attributes of different liquid crystalline system along with the brief introduction about these materials, including the brief history of chirality in achiral banana-shaped molecules. A details description about the different mesogenic phases identified in bent-core compounds, how they classified and varies phase are described.

**Chapter 2** describes the survey about banana-shaped liquid crystals of different molecular structures reported in the literature is discussed. This chapter also gives an idea about the current research work in the field of banana shaped liquid crystals.

**Chapter 3** discussed the synthetic steps for efficient and elegant route towards the successful synthesis of the desired compound. Chemical characterization methods with spectral data of the synthesized compound and procedure involved for the synthesis are mentioned.

**Chapter 4(a)** describes the designed and synthesized of the achiral unsymmetrical four-ring bent-core liquid crystals with strongly polar cyano moiety as substituent at one end and alkoxy group (butyl to dodecyl) at the other end exhibiting exotic nematic phases over a wide temperature range. The light induced cis-trans isomerization is also discussed.

**Chapter 4(b)** deals with the design, synthesis and influence of polar, non-polar lateral substituents and non-polar methyl substituent at the transverse direction on mesomorphism in four ring bent-core mesogens consists of imine, ester and photochromic azo as linking groups with strongly polar cyano moiety as substituent at one end and alkoxy group (butyl, hexyl and dodecyl) at the other wing. All the compounds exhibiting enantiotropic nematic phase with high thermal stability.
Chapter 4(c) describes achiral unsymmetrical four-ring bent-core compounds possessing unequal chain lengths and different substituents in the central core of the molecule. All the compounds exhibit a wide variety of nematic and smectic polymorphism. The formation of different mesophase is not solely determined by the position of the substituent but also type of the substituent. These molecules are well designed to possess two hydroxyl groups in ortho position to imine linkage in both the wings to participate in inter and/or intramolecular H-bonding with imine nitrogen atom which adds to the strength and molecular interactions.

Chapter 4(d) deals with the substituted four ring bent-core liquid crystal and their phase behaviours. These compounds are thermally and hydrolytically stable due to inter- or intra molecular hydrogen bonding and exhibit 2D polarization splay modulated layer undulated banana mesomorphic phases. Two lateral fluorine substitutions in achiral unsymmetrical four ring bent-core mesogens yielded a new family exhibiting B1RevTilted phases.

Chapter 4(e) describes the influence of two fluorine substituents in the central phenyl ring of achiral unsymmetrical four ring bent-core molecule. It is observed that the substituent plays an important role in promoting the chiral banana phase. These molecules are well designed to possess two hydroxyl groups in ortho position to imine linkage in both the wings to participate in inter and/or intra-molecular H-bonding with imine nitrogen atom which adds to the strength and molecular interactions in the formation of layer modulated and undulated smectic phases. The influence of substituent on mesophase behaviour and emissive property are presented.