# CONTENTS

## CHAPTER -1

**Introduction** 1-10

1.1. Evaluation of older Colour Systems for expressing colours 1

1.1.1 Contribution of Aristotle 2

1.1.2 Colour Scale 2

1.1.3 Contribution of Leonardo Da Vinci 3

1.1.4 Contribution of Sir Isaac Newton and others 3

1.1.5 Munsell’s Colour System 4

1.1.6 Natural Colour System 5

1.1.7 Quantification of Colour 6

1.2. Problem Statement 7

1.3. Challenges 7

1.4. Requirements 7

1.5. Problem Solution 7

1.6. Need for the Study 8

1.7. Objectives of the research 8

1.8. Motivation 9

1.9. Methodology for Solving the Problem 9

1.10. Benefits of the Research Work 9

1.11. Merits of the Research Work 10

1.12. Thesis organization 10

## CHAPTER -2

**Literature Survey** 11-22
CHAPTER -3

Contrast and CIE L*a*b* measurement methods, other

Colour Spaces and Models

2.1. Contrast Measurement

2.1.1 Colour

2.1.2 Contrast and Colour Measurement

2.1.2.1 Densitometry

2.1.2.2 Quality parameters

2.1.2.3 Contrast

2.1.2.4 Spectral Colour Measurement

2.1.2.5 Print Contrast Testing

2.2. CIE L*a*b* Measurement

2.2.1 CIE Standard Observer

2.2.2 Colour Matching Functions

2.2.3 CIE L*a*b* colour System

2.2.3.1 Delta E value

2.2.3.2 Problems with CIE L*a*b Colour Space

2.2.3.3 CIE 2000 colour Difference Formula

2.3. Other Colour Space

2.3.1 CIE xyz Colour Space

2.3.1.1 x_{10} y_{10} z_{10} Tristimulus Values

2.3.1.2 xyz Chromaticity Coordinates

2.3.2 L*e*h Colour Space

2.3.3 L*u*v* Colour Space

2.3.4 CIE 1976 UCS Diagram
2.4. Colour Models

2.4.1 RYB Colour Model
2.4.2 RGB Colour Model
2.4.3 CMY / CMYK Colour Model
2.4.4 YCC Colour Model

2.5. Measurement Standards for Spectral Colour

CHAPTER -4

Master Design & Experiments

4.1. Master Design
4.2. Experiments

4.2.1 Experiment Stage-I
4.2.2 Experiment Stage-II
4.2.3 Experiment Stage-III
4.2.4 Experiment Stage-IV
4.2.5 Experiment Stage-V
4.2.6 Hue Colour Vision Test of Standard Observers
4.2.7 Machine, Equipments and Experiment Conditions

CHAPTER -5

Data Collection

5.1. Systematic Sampling of Printed Sheets
5.2. Measuring Instrument
5.3. Data of 100 Selected Sample Sheets
5.4. Z-Test

5.4.1 Scatter Plot of Average Delta E Values of 100 Sample Sheets
5.4.2. Descriptive Statistics of Average of 100 Sample Sheets 121

5.4.3. One-Sample Statistics 121

5.4.4. Criteria for Acceptance or Rejection of Null Hypothesis 122

5.5. Standard Observers Judgement Record of Ten Sheets 122

CHAPTER -6

Data Analysis 135-174


   6.1.1. Observation Record of D50 Light and Florescent Light 156
   6.1.2. Observation Record of Florescent Light and U30 Light 158
   6.1.3. Observation Record of D50 Light and D50 with UV Light 160
   6.1.4. Minimum Delta E value and the Delta E value Selected by Maximum Standard Observers in D50 Light 170

CHAPTER -7

Conclusions and Future Scope 175-178

References 179-186

Appendix i-viii

List of Publications ix-x