## CONTENTS

### CHAPTER I – INTRODUCTION

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>1</td>
</tr>
<tr>
<td>1.2</td>
<td>1</td>
</tr>
<tr>
<td>1.3</td>
<td>3</td>
</tr>
<tr>
<td>1.4</td>
<td>5</td>
</tr>
<tr>
<td>1.5</td>
<td>6</td>
</tr>
<tr>
<td>1.6</td>
<td>8</td>
</tr>
<tr>
<td>1.7</td>
<td>10</td>
</tr>
</tbody>
</table>

### CHAPTER II - LITERATURE REVIEW

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>12</td>
</tr>
<tr>
<td>2.2</td>
<td>41</td>
</tr>
</tbody>
</table>

### CHAPTER III – SYNTHESIS OF NANO CRYSTALS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Nano crystals</td>
<td>54</td>
</tr>
<tr>
<td>3.2 Physical methods</td>
<td>56</td>
</tr>
<tr>
<td>3.3 Ball milling</td>
<td>56</td>
</tr>
<tr>
<td>3.4 Inert Gas Condensation</td>
<td>58</td>
</tr>
<tr>
<td>3.5 Arc Discharge</td>
<td>59</td>
</tr>
<tr>
<td>3.6 Ion Sputtering</td>
<td>60</td>
</tr>
<tr>
<td>3.7 Laser Ablation</td>
<td>60</td>
</tr>
<tr>
<td>3.8 Pyrolysis and Other Methods</td>
<td>61</td>
</tr>
</tbody>
</table>
CHAPTER IV - CHARACTERIZATION

4.1 Introduction

4.2 Structural Characterization

4.3 X-ray diffraction (XRD)

4.4 Scanning Electron Microscope (SEM)

4.5 Transmission Electron Microscope (TEM)

4.6 X-ray Photoelectron Spectroscopy (XPS)

4.7 Optical Studies

4.7.1 UV – Vis Spectral Analysis
CHAPTER V – RESULTS AND DISCUSSIONS

5.1 XRD ANALYSIS
   5.1.1 XRD Patterns of Mn Doped ZnO 118
   5.1.2 XRD Patterns of Cu Doped ZnO 121
   5.1.3 XRD Patterns of Co Doped ZnO 123
   5.1.4 XRD Patterns of Ni Doped ZnO 127

5.2 SEM and EDAX Analysis of the samples 130

5.3 EDAX Analysis of all the Transition Metal Doped Metal Oxides 145

5.4 TEM Studies 158

5.5 Optical Properties 164
   5.5.1 UV-Vis absorption spectroscopy 164
   5.5.2 Overlay absorption spectrum of doped ZnO nanocrystals 165
   5.5.3 UV-Vis absorption spectrum of Zn_{1-x}Mn_{x}O 166
5.5.4 UV-Vis absorption spectrum of Zn\(_{1-x}\)Cu\(_x\)O
5.5.5 UV-Vis absorption spectrum of Zn\(_{1-x}\)Co\(_x\)O
5.5.6 UV-Vis absorption spectrum of Zn\(_{1-x}\)Ni\(_x\)O

5.6 FT-IR ANALYSIS
5.6.1 FT-IR analysis of Mn doped Zno
5.6.2 FT-IR analysis of Cu doped Zno
5.6.3 FT-IR analysis of Co doped Zno
5.6.4 FT-IR analysis of Ni doped Zno

5.7 VSM ANALYSIS
5.7.1 Magnetic behavior of Zn\(_{1-x}\)Mn\(_x\)O
5.7.2 Magnetic behavior of Zn\(_{1-x}\)Cu\(_x\)O
5.7.3 Magnetic behavior of Zn\(_{1-x}\)Co\(_x\)O
5.7.4 Magnetic behavior of Zn\(_{1-x}\)Ni\(_x\)O

5.8 ESR SPECTRUM ANALYSIS
5.8.1 ESR Spectrum of Zn\(_{1-x}\)Mn\(_x\)O
5.8.2 ESR Spectrum of Zn\(_{1-x}\)Cu\(_x\)O
5.8.3 ESR Spectrum of Zn\(_{1-x}\)Co\(_x\)O

5.9 PHOTOLUMINESCENCE STUDIES
5.9.1 Photoluminescence Spectrum For Zn\(_{1-x}\)Mn\(_x\)O
5.9.2 Photoluminescence Spectrum For Zn\(_{1-x}\)Cu\(_x\)O
5.9.3 Photoluminescence Spectrum For Zn\(_{1-x}\)Co\(_x\)O
5.9.4 Photoluminescence Spectrum For Zn\(_{1-x}\)Ni\(_x\)O

5.10 References
CHAPTER VI

FUTURE SCOPE 205

APPENDIXES

A.  Resume of the Candidate  206
B.  List of Publications by the Candidate  208