## CONTENTS

### CHAPTER 1

**FRACTALS AND FRACTAL GEOMETRY**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Introduction to Fractals</td>
<td>1-29</td>
</tr>
<tr>
<td>1.2 Fractal Geometry</td>
<td></td>
</tr>
<tr>
<td>1.3 Mathematics in Fractal</td>
<td></td>
</tr>
<tr>
<td>1.3.1 The Sierpinski Gasket</td>
<td></td>
</tr>
<tr>
<td>1.3.2 The length of Coastline</td>
<td></td>
</tr>
<tr>
<td>1.4 Famous standard Fractal Sets</td>
<td></td>
</tr>
<tr>
<td>1.4.1 The Mandelbrot Set</td>
<td></td>
</tr>
<tr>
<td>1.4.2 The Julia Set</td>
<td></td>
</tr>
<tr>
<td>1.4.3 The Cantor Set</td>
<td></td>
</tr>
<tr>
<td>1.5 Impact on the Sciences</td>
<td></td>
</tr>
<tr>
<td>1.6 The Problem</td>
<td></td>
</tr>
<tr>
<td>References</td>
<td></td>
</tr>
</tbody>
</table>

### CHAPTER 2

**FRACTALS AND CONCEPT OF FRACTAL DIMENSION**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Regular fractals</td>
<td>30-51</td>
</tr>
<tr>
<td>2.2 Random Fractal</td>
<td></td>
</tr>
<tr>
<td>2.3 Methods of measuring fractal Dimension of objects.</td>
<td></td>
</tr>
<tr>
<td>2.3.1 Box-Counting (Grid) Method.</td>
<td></td>
</tr>
<tr>
<td>2.3.2 Dividers (compass) Method.</td>
<td></td>
</tr>
<tr>
<td>2.3.3 Mass radius method.</td>
<td></td>
</tr>
</tbody>
</table>
2.3.4 The Hausdorff Dimension

2.3.5 Area –Perimeter Relationship.

2.3.6 Perimeter Dimension

2.3.7 Area Dimension

References

CHAPTER 3

FRACTAL AND SELF-SIMILARITY (52-67)

3.1 What is fractal Self-similarity?

3.2 Scaling and self Similarity

3.3 Example of self –similarity

3.4 Self Similarity Dimension

3.5 Self-Similarity Dimension and Length in Famous fractal set.

3.6 Conclusion and Summary

References

CHAPTER 4

VISCOS FINGERING (68-111)

4.1 Introduction:

4.2 Design and construction of Hele Shaw cell.

4.2.1 Construction of Cell

4.2.2 Precautions.

4.3 Experimental set up for recording of the growth process

4.4 Study of Viscous fingering in Hele Shaw cell under different
conditions

4.4.1 Laplace Equation
4.4.2 Mathematical Approach.

4.4.3 Laplacian Growth.

4.4.4 Viscous fingering

4.5 Study of Time Course of Evolution of Fingers

4.6 Study of Growth Velocity of Fingers

4.7 Effect of pressure

4.8 Characterisation of growth patterns:

4.8.1 Box counting Method

4.8.2 Richardson Plot Technique

References

CHAPTER 5

ELECTRODEPOSITION  (112-146)

5.1 Background

5.2 Design and construction of cell for growth of dendritic patterns using electrodeposition

5.3 Electrodeposition of copper under constant voltage condition

5.3.1 Experimental set up

5.3.2 Experiment

5.3.3 Growth Under constant Electric field

5.4 Computer controlled power Supply

a) DAC-0808

b) Printer Port in SPP mode

5.4.1 Constant voltage power supply controlled by computer.

5.4.2 Computer controlled constant current power supply
5.4.3 Testing of voltage to current converter circuit

5.5 Controlling logic and programme
   a) Constant voltage supply
   b) Controlled current Supply

References

CHAPTER 6
RESISTANCE OF CELL IN ELECTRODEPOSITION (147-169)

6.1 Basic Concept of electrical resistance of the electrodeposition cell.

6.2 Design and construction of computer controlled data acquisition system using ADC 0809 and printer port interface.

6.3 Controlling programme logic for Data acquisition System

6.4 Measurement of resistance of the Electro-deposition Cell at regular interval of time during the growth process.

References

CHAPTER 7
COMPUTER SIMULATION OF ELECTRODEPOSITION (170-206)

7.1 Study of Diffusion Limited Aggregation (DLA)

7.2 Simulation of DLA using off lattice walk

7.3 Neighbor dependent sticking probability.

7.4 Simulation under low field conditions

7.5 Effect of Random numbers used in the simulation

7.6 Simulation of the effect of electric field

7.7 Mass radius method

7.8 Fractal dimension based on radius of gyration

7.9 Drifting of center of mass in DLA
CHAPTER 8

Rescale Range Analysis of Time Series

8.1 Introduction

8.2 Rescaled rage analysis (R/S) analysis and the Hurst exponent.
   8.2.1 Hurst Exponent (H)
   8.2.2 Data Analysis of Time series

8.3 Application of R/S analysis to the weather data.
   8.3.1 R/S analysis of temperature data
   8.3.2 R/S analysis of Humidity data

8.4 Application of R/S analysis to the drift of the center of mass in the
   simulation of DLA (of chapter 7).
   8.4.1 R/S analysis of Drifting Center of Mass in DLA
   8.4.2 R/S analysis of Number of steps before sticking
   8.4.3 R/S analysis of Share Market Prices

References

Summary

Papers presented